Bayswater B Power Station

Final Part 3A Bushfire Risk Assessment

Prepared for
AECOM

27 August 2009

Proposed Bayswater B Power Station

Final Bushfire Risk Assessment

PREPARED FOR	**AECOM**
PROJECT NO	**09NEWECO-0014**
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Contents

List of Figures

List of Tables

1 Introduction

1.1 BACKGROUND

The construction of a new base load power station in NSW is being considered. Eco Logical Australia (ELA) was commissioned by AECOM to undertake a Bushfire Risk Assessment of, for concept approval, the Bayswater B base load power station in the Upper Hunter Region of New South Wales. The proposed Bayswater Liddell Power Generation Complex (referred to as "Bayswater B") is to be powered by either coal or natural gas. Concept Plan approval is being sought for both possible operating scenarios under Part 3A of the *Environmental Planning & Assessment Act 1979* (EP&A Act) and *State Environmental Planning Policy (Major Projects) 2005*.

This report provides required supporting information with respect to bushfire risk at the site as specified by the Minister of Planning and relevant agencies in the Director General's requirements (issued on 4th July 2009) for the Concept Plan application.

Specifically, this report describes the bushfire hazard on the site and identifies a variety of assets across the site that are at risk of impact from bushfire. The risk to these assets is considered in the context of their proximity to hazards, the resilience of the asset, the consequence of impact and the likelihood of an impact occurring. This assessment has also considered the potential for assets on the site (conveyor, transmission lines) to cause ignition of a bushfire.

The risk assessment has identified that a residual low level of risk is acceptable. Several assets have been identified as being of moderate risk and a series of risk treatment strategies have been recommended that will reduce the risk to an acceptable low residual level.

The risk treatment strategies include:

1. Implementation of construction standards for all buildings to the level of AS3959, *Construction of Buildings in Bushfire Prone Areas* (Standards Australia, 2000);

2. Incorporation of bushfire response into an overarching emergency management plan for the site, including identification of training and evacuation requirements for staff;

3. Preparation of a bushfire management plan that addresses management of the surrounding bushfire hazard, environmental values and ignition potential from transmission lines and conveyor(s); and

4. Implementation of a communication plan with local and district RFS staff that includes an induction to the site and input into emergency response procedures.

This document broadly follows a process identified in The Australia/New Zealand Standard *AS/NZS 4360: 2004 Risk Management*.

1.2 DESCRIPTION OF PROPOSAL

Macquarie Generation (MacGen) currently operate the Bayswater and Liddell Power Stations, located in the Central Hunter Region of New South Wales. MacGen, as proponent for this concept approval, is proposing

an additional 2000 MW of generating power in order to meet the forecast base load demands of New South Wales. The proposed new base load power plant, known as "Bayswater B", is to be situated on land west of the existing Bayswater Power Station.

The Concept Plan considers two potential operating scenarios for the new base load power plant including:

1) Coal fired (Figure 1), and;

2) Gas fired (Figure 2).

The Concept Plan design components and approximate development areas for the coal fired scenario include: a main power plant (comprised of boiler plant and turbine plant totalling 0.3 ha), transmission infrastructure including switchyard (0.1 ha) and 500 kV transmission lines (two lines totalling 6 km), coal stockpile area, water treatment and chemical storage, raw material transportation (coal and limestone) via roads (haulage road 2.2 km) and conveyor from Antiene rail coal unloader (5.5 km), and access roads to site (3.8 km) and within the site.

The design components and approximate areas for the gas fired operating scenario include: a main power plant (comprised of five combined cycle gas turbine units), gas supply via a spur pipeline (15 km), transmission infrastructure including switchyard and lines (two lines totalling 6 km), water treatment and chemical storage, access roads to site (3.8 km) and within the site. The lay down area for the plant and switchyard components would be similar in size to the plant area (i.e. 0.4 hectares).

Development of these components will be undertaken through a staged construction approach involving site establishment, (levelling and establishment of a construction lay down area, accommodation for employees, site access), erection of components and commissioning. Construction is expected to occur over a two year period between 2014 and 2016.

1.3 LOCATION AND DESCRIPTION OF THE SUBJECT LAND

The study site lies between the towns of Singleton and Muswellbrook, about 250 km north of Sydney and is located within the Local Government Areas of Muswellbrook and Singleton, covering an area of approximately 2,000 hectares. East of the site is the existing Bayswater Power Station and the New England Highway. North and south of the site is relatively cleared land comprising primarily mining and agricultural enterprises. Stands of native vegetation adjoin the western boundary, and are scattered amongst native and improved pastures to the south and west.

Cattle graze the study site, however, grazing pressure is very low. Cattle can access most of the site, except for the eastern most parts of the remnant woodland. Rabbits have a localised effect, being abundant in some locations which effects local diversity and biomass. Kangaroos are also abundant in the modified grassland.

The site is currently zoned Rural 1(a) under the Singleton Local Environment Plan (LEP) 1996. Infrastructure associated with the project may be located within the adjacent Muswellbrook LGA. Infrastructure associated with the development will be located on land zoned Infrastructure SP2 "Power Station" and RU1"Primary Production" (for the ash conveyor only), under the provisions of Muswellbrook LEP 2009.

The predominant drainage pattern within the study area is from north to south with minor tributaries flowing into Saltwater Creek which empties into Lake Plashett. Waterways comprise both poorly defined and well defined ephemeral creeks higher in the catchment and permanent features towards Lake Plashett. A

number of aquatic features have been altered (waterways) or created (dams and channels) to cater for power plant operations.

Notable water bodies within the locality include Lake Plashett, at the southern extent of the study area and Lake Liddell a sizeable reservoir that occurs to the north-east of the site, adjacent to the New England Highway.

Figure 1: Concept Plan design of the proposed Coal Fired Plant, Bayswater B (supplied by AECOM).

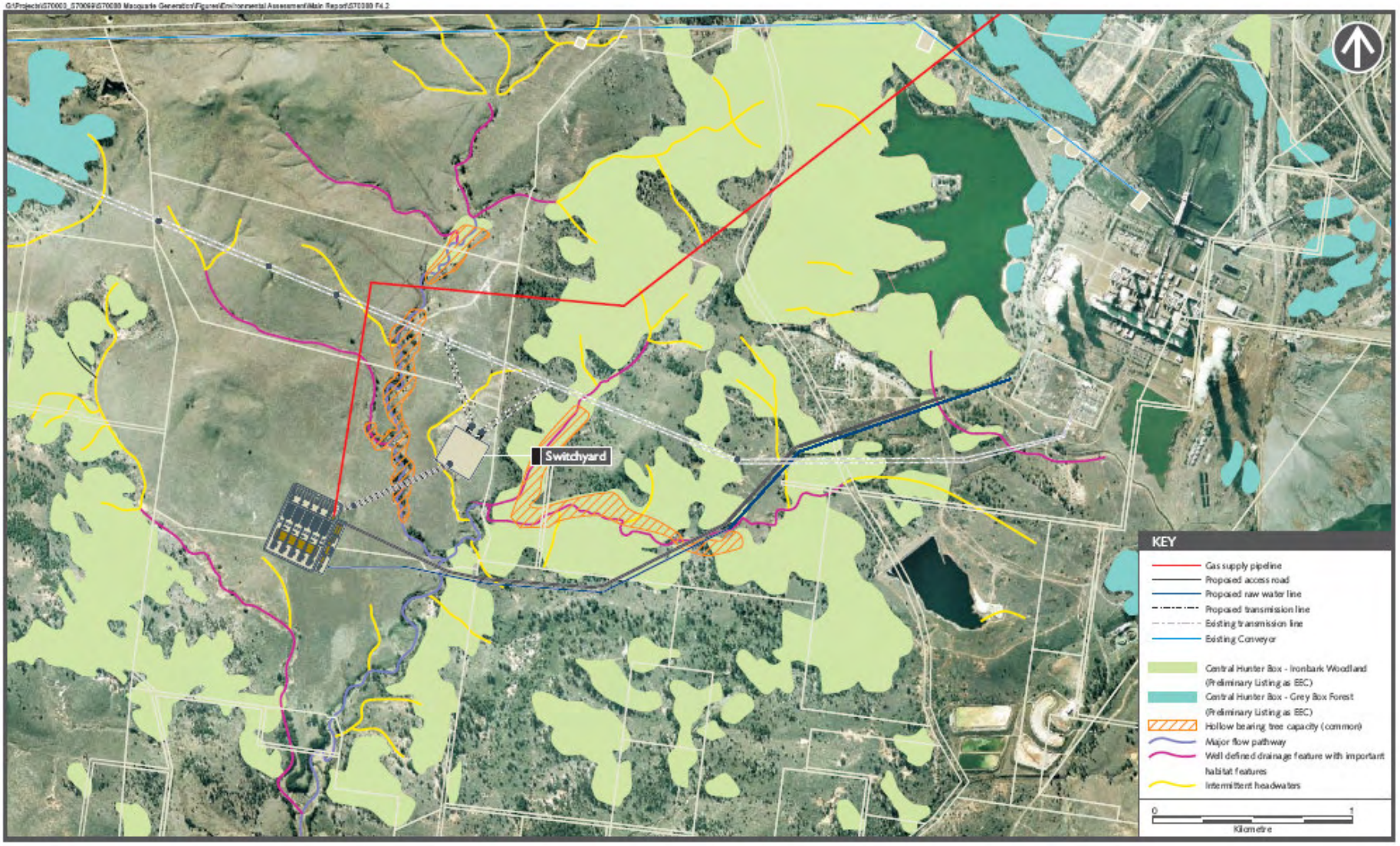

Figure 2: Concept Plan design of the proposed Gas Fired Plant, Bayswater B (supplied by AECOM).

2 Methods

The Australia/New Zealand Standard *AS/NZS 4360: 2004 Risk Management* was used as the basis for the risk assessment process. See Figure 3 for the steps involved.

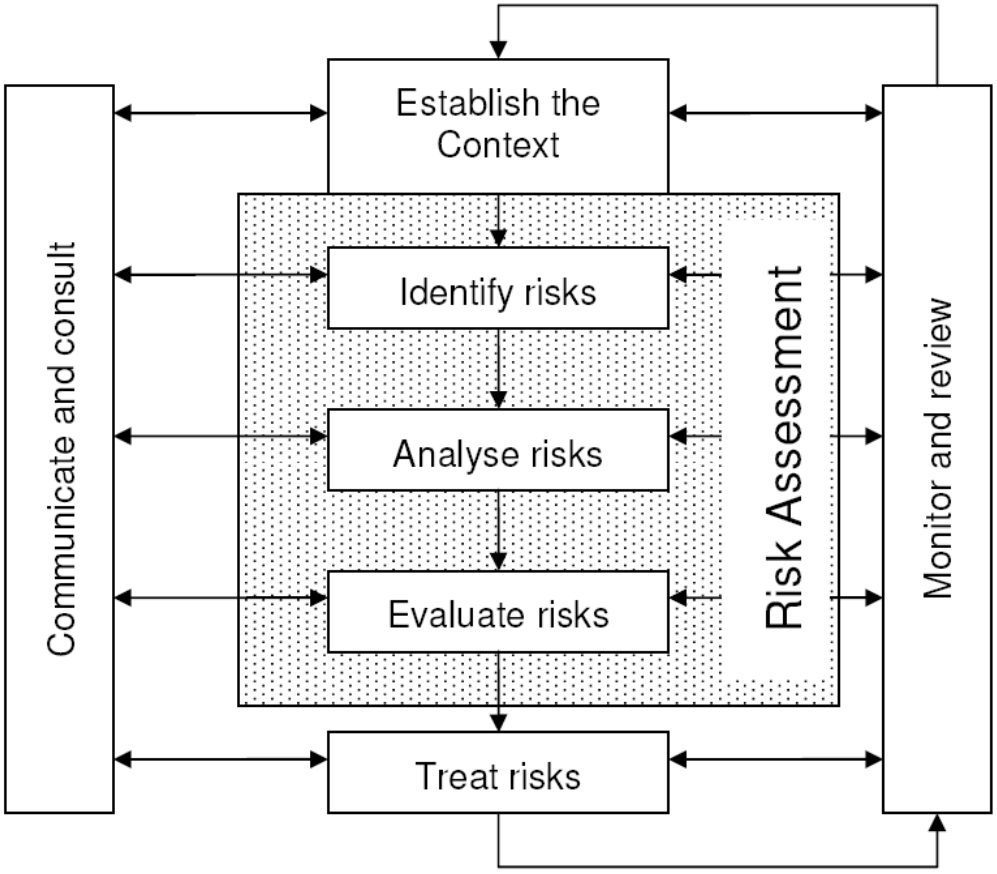

Figure 3: Overview of the risk assessment process

The above process was used to develop the following detailed bushfire risk assessment procedure:

1. Identification of aims and objectives for bushfire risk;
2. Identification of the bushfire hazard;
3. Identification of assets (life, property and environment);
4. Qualitative assessment of the likelihood (or risk) of impact to assets; and
5. Identification of risk treatment options.

3 Results

3.1 CONTEXT

This assessment has been undertaken in the context of the proposed development, and the site and surrounds within which development takes place. A full assessment of broader operational and organisational context is beyond the scope of the bushfire risk assessment and has not been undertaken.

The aim of the risk assessment is to:

> Identify, assess and reduce the risk from bushfire to staff, emergency service personnel and the economic values of the site to a low level whilst minimising the impact on the surrounding environment.

This is to be achieved through:

1. Training and communicating with people who will use the site;
2. Limiting the potential of a fire igniting and spreading on or from the site;
3. Providing sufficient protection to assets;
4. Ensuring land management is undertaken in a sustainable manner.

3.2 RISK IDENTIFICATION

3.2.1 Bushfire Hazard

Identification of bushfire hazard is the first step in assessing bushfire risk at a site. Bushfire hazard is used to determine the relative fire behaviour across the site as this influences bushfire attack mechanisms including direct flame contact, radiant heat, smoke, wind and ember attack.

Bushfire hazard is determined by combining the following parameters:

1. Fuel load;
2. Topography; and
3. Climatic conditions.

Vegetation structure is used as a surrogate for fuel loads. Across the site, the following vegetation structures, and consequent bushfire risk hazards are present (Figure 4):

- Woodland – High Hazard
- Unmanaged Grasslands – Moderate Hazard
- Grazed Pasture – Low Hazard

Topographically, the site is gently undulating with areas of steeper slopes located within the centre of the site, and generally overlapping with areas of woodland and unmanaged grasslands. Consequently, the areas of highest bushfire hazard from a topographic perspective overlap with the areas of highest hazard from a fuel load perspective.

Climatic conditions are influenced by:

- Seasonal conditions (particularly drought);
- Temperature;
- Relative humidity; and
- Wind Speed.

Due to the small scale of the site, climatic conditions have little impact on the relative bushfire hazard across the site. Whilst daily weather conditions can influence bushfire behaviour due to wind directions and aspect, wind conditions are highly variably during extreme bushfire weather conditions, consequently, aspect is usually not included when assessing overall bushfire hazard.

As such, the greatest impacts from climatic conditions are on a temporal rather than a spatial basis. The Hunter Valley has a long bushfire season that can start as early as August and continues into March. Extreme bushfire danger periods usually follow extended periods of drought and are associated with strong, hot, dry westerly winds.

3.2.2 Assets

The second stage in assessing risk is identifying the type, location and potential impact to assets. This information is then combined in a matrix to assess the overall risk across the site. Assets that have been assessed include:

1. Personnel;
2. Fire Fighters;
3. Power Station and ancillary buildings;
4. Haulage road;
5. 500kV transmission line;
6. Transmission lines to switchyard;
7. Proposed conveyor(s);
8. Alternative access road; and
9. Ecological assets.

Another class of assets that was not assessed is cultural heritage assets. This can include indigenous and European heritage.

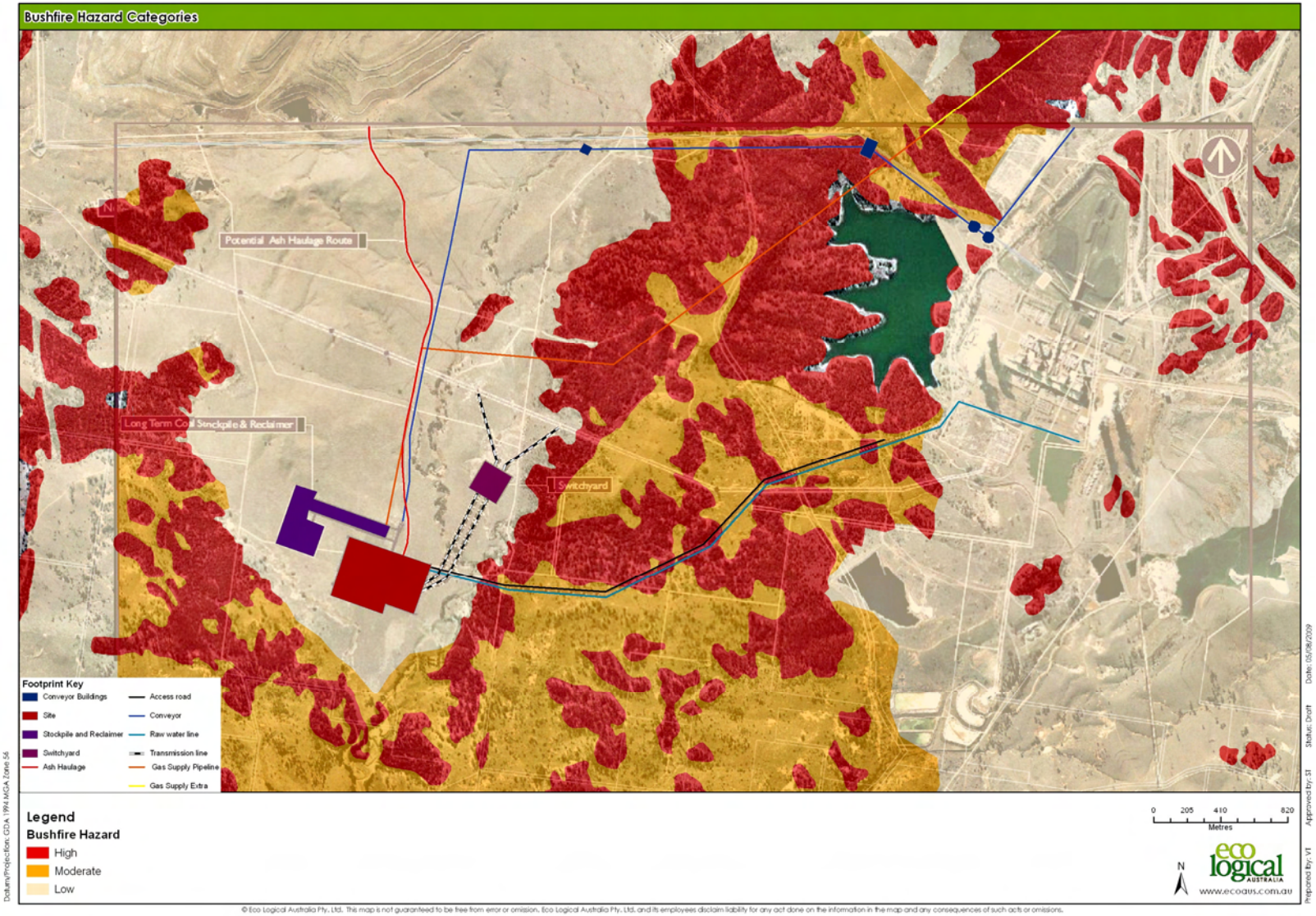

Figure 4: Bushfire hazard.

3.3 RISK ASSESSMENT

Risk assessment has been undertaken in a tabular form which has considered:

1. The type of asset and proximity to the hazard;
2. The level of preparedness for a bushfire event;
3. The consequence of a bushfire event;
4. The likelihood of a bushfire event occurring; and
5. The overall risk to each asset.

The risk assessment has been undertaken on a qualitative basis with a relative risk ranking from negligible to high allocated to each asset. The assessment has considered both the risk of fire to an asset, and also the potential for an asset to ignite a fire and the potential consequences of such an ignition (Table 1).

Any risk classed as moderate or greater does not achieve the aim of reducing the risk to a low level and requires treatment.

Table 1: Risk Assessment Matrix

Asset	Hazard Rating	Distance from hazard	Preparedness Level	Consequence Rating	Likelihood Rating	Risk Rating	Notes	Risk Treatment
Site Staff	High	>100m	Site specific plans in place	High	Moderate	Moderate	Onsite evacuation plan and training available	Management Plan and training
Fire Fighters	High	0	Generic Training	High	Moderate	Moderate	Potential impacts whilst fighting fires on unfamiliar site	Management Plan and communication
Power Station & Ancillary Buildings	High	>100m	Regular site management	High	Low	Moderate	Potential ember attack	Inclusion of bushfire in emergency management plan and provision of emergency response equipment
500kV Transmission Line	High	0	Occasional management	High	Moderate	Moderate	Potential for fire ignition	Management Plan
Transmission Lines to Switchyard	High	0	Occasional management	High	Moderate	Moderate	Potential for fire ignition	Management Plan
Proposed Conveyor	High	0	Occasional management	High	Moderate	Moderate	Potential for fire ignition	Management Plan
Alternative Access Road	High	0	Occasional management	Low	Moderate	Low	Minimal impact to asset	Management Plan
Ecological Assets	High	0	Not prepared	Moderate	High	Moderate	Potential for impact from high fire frequencies	Management Plan
Cultural Assets	Unknown	Unknown	Unknown	Unknown	Unknown	Unknown	Not assessed	Not assessed

3.4 RISK TREATMENT

The objective of risk treatment strategies is to reduce bushfire risk to an acceptable level. In its simplest form this may involve:

1. Improving the resilience of the asset;

2. Reducing the hazard; and

3. Implementing strategies to improve preparedness and emergency response.

It is considered that all risks at the site can be treated to a level where the residual risk is low, and at a level that is acceptable. Key treatments to achieve this include:

1. Implementation of construction standards for all buildings to the level of AS3959-1999, *Construction of Buildings in Bushfire Prone Areas* (Standards Australia, 2000);

2. Construction of roads for emergency access and egress and provision of water to comply with AS2419.1-1994 Fire Hydrant Installations (Standards Australia, 1994);

3. Incorporation of bushfire response into an overarching emergency management plan for the site, including identification of training and evacuation requirements for staff;

4. Preparation of a bushfire management plan that addresses management of the surrounding bushfire hazard, environmental values and ignition potential from transmission lines and conveyor(s); and

5. Implementation of a communication plan with local and district RFS staff that includes an induction to the site and input into emergency response procedures.

6. Clearance of a 15 m buffer of vegetation along either side of the proposed conveyor route to address the potential for fire ignition as a result of conveyor operations.

7. Electricity and gas services should be located such that they do not pose a hazard to surrounding bushland and buildings, or provide an obstacle for emergency service personnel. Ideally they would be located underground. Powerlines will need to undergo regular inspection to ensure that no part of a tree is closer than the distances set out in 'Vegetation safety clearances' issued by Energy Australia (*NS179*, April 2002).

4 Conclusion

This bushfire risk assessment has identified the bushfire hazard on the site and the risk of impact to the assets across the site. Currently for each scenario (coal fired and gas fired), there are a number of assets that are considered to be at a moderate level of risk. A number of key treatment strategies have been identified that if implemented will reduce the residual risk to a low and acceptable level.

In the author's professional opinion the proposed development can be undertaken in a manner that reduces risk to an acceptable level, providing recommended risk treatment strategies are implemented appropriately.

Steven House

Director

Eco Logical Australia Pty Ltd

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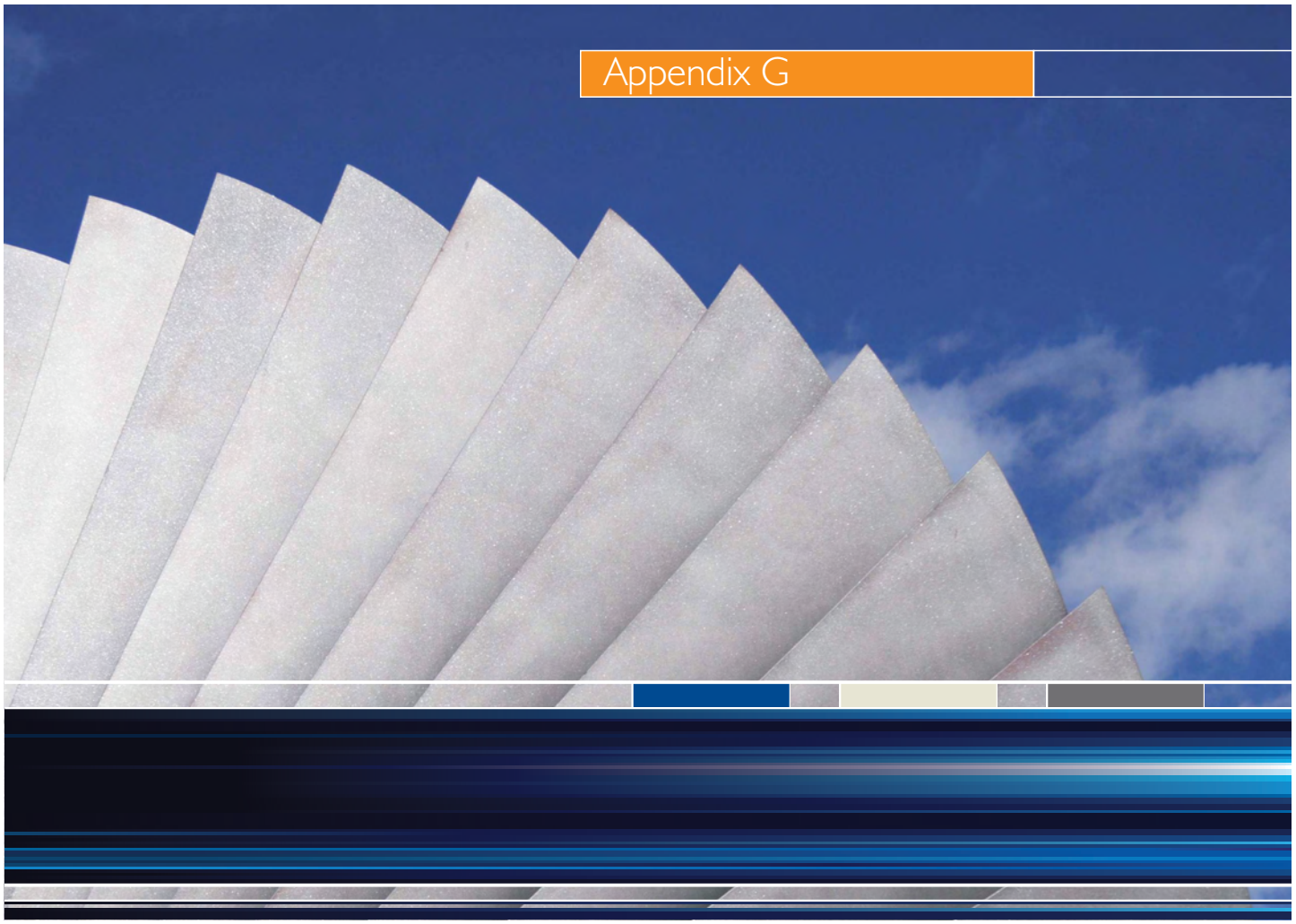

Appendix G

Heritage Assessment

AECOM

Prepared for:

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Bayswater Liddell Power Generation Complex Environmental Assessment: Heritage
Bayswater

Final

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Environment

Distribution

Bayswater Liddell Power Generation Complex Environmental Assessment: Heritage Bayswater

18 September 2009

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Contents

List of Tables

Body Report

Tables Section

List of Figures

Figures Section

List of Plates

Plates Section

List of Appendices

Glossary of Terms

Activity Area	A pattern of artefacts in a site indicating that a specific activity took place.
Adaptation	Adaptation means modifying a place to suit proposed compatible uses.
Alluvial	Pertaining to sediment mass deposited from transport by channelled stream flow or over-bank stream flow.
Anvil	Object that supports a stone artefact that is being struck with a hammer.
Archaeological Potential	The likelihood of the presence of archaeological evidence ascertained through physical evaluation (survey, test excavations) and historical research.
Artefact Scatter	A collection of artefacts usually distributed across the surface of the ground.
Aboriginal Object	*'…any deposit, object or material evidence (not being a handicraft made for sale) relating to the Aboriginal habitation of the area that comprises New South Wales, being habitation before or concurrent (or both) the occupation of that area by persons of non-Aboriginal extraction, and includes Aboriginal remains'* (s.5 NPW Act)
Aboriginal Place	Any place declared to be an Aboriginal place under s.84 of the *National Parks and Wildlife Act 1974* (NPW Act) because the place is or was of special significance with respect to Aboriginal culture. It may or may not contain Aboriginal objects.
Aboriginal Scarred Tree	A tree that bears a scar or scars which are wounds formed from the deliberate removal of bark or wood by Aboriginal people. Aboriginal scarred trees are often an indicator of an activity area.
Aboriginal Site	In this study, the term is used to define the present physical extent of visible Aboriginal archaeological material.
Archaeological Terrain Unit (ATU)	A term used by some archaeologists to denote areas of a landscape based on landform element and class of slope. These are discrete, recurring areas of land for which advocates of the term assume are associated with discrete Aboriginal activity and therefore archaeological evidence in one part of an ATU can be extrapolated to other similar locations (Kuskie 1999: 67).
Artefact	Any object which is physically modified by humans.
Assemblage	A collection of artefacts associated by a particular place or time and assumed generated by a single group of people. An assemblage can comprise different artefact types.

Attribute	A well defined feature of an artefact that cannot be further subdivided. Archaeologists identify types of attributes, including form, style and technology, in order to classify and interpret artefacts.
Axe	A stone-headed axe characteristically containing two ground surfaces which meet at a bevel.
Backed Artefact	A stone tool where one margin of a flake is retouched at a steep angle and that margin is opposite a sharp edge.
Background Scatter	A term sometimes used to describe a low density scatter of isolated finds that are distributed through the landscape without any obvious focal point.
Basalt	Igneous volcanic rock sometimes used to make stone artefacts, although it is often unsuitable for stone implement production. Basalt is common in eastern Australia where there has been recent volcanic activity.
Bipolar Flake	A stone artefact made by striking into an anvil with a hammerstone. Bipolar flakes display crushing at either end.
Blade	A flake that is at least twice as long as it is wide.
Bondi Point	A small asymmetrical backed artefact with a point at one end and backing retouch.
Burin	A stone tool flaked on one or both ends to form a small chisel or grooving tool.
Burra Charter	The Burra Charter provides guidance for the conservation and management of places of cultural significance Australia. It sets a standard of practice for those who provide advice, make decisions about, or undertake works to places of cultural significance, including owners, managers and custodians. The most recent version of the Burra Charter was adopted by Australia ICOMOS (the Australian National Committee of ICOMOS) on 26 November 1999.
Chert	A crypto-crystalline sedimentary siliceous rock commonly used in the manufacture of stone implements.
Conjoin	A physical link between artefacts broken in antiquity.
Conjoin Set	A number of artefacts refitted together.
Conservation	As defined in The Burra Charter, conservation means all the processes of looking after a place so as to retain its cultural significance.
Conservation Area	A defined area of the landscape conserved in perpetuity for the management of the heritage values of that landscape.

Conservation Management Plan	A document that outlines the cultural heritage significance of an object or area and policies, guidelines, maintenance and strategies for the conservation of the object or area.
Contact Site	A site that displays an interaction between early colonists and Aboriginal Australians.
Core	A piece of flaked stone which has one or more negative flake scars but no positive flake scars.
Cortex	Weathered outer surface of a rock, usually chemically altered.
Country	A term used by Aboriginal people to refer to the land to which they belong.
Cultural Significance	Cultural significance means aesthetic, historic, scientific, social or spiritual value for past, present or future generations (Australia ICOMOS Burra Charter Article 1.2).
Datum	The datum point is the location from which all measurements on a site are made. The datum point is tied into local survey maps.
Desktop Survey	A study that does not involve any field-based activity and only involves background research and reporting.
Diffusion	The spread of a cultural trait from one area to another by means of contact between people.
Distal	The terminating end of a flake opposite the bulb.
Edge Damage	The removal of small flakes, or crushing, from the edge of an artefact.
Effective Coverage	A quantifiable estimate of the area in which archaeological materials are “detectable”, i.e. exposed ground surface area.
Elouera	A type of backed blade, triangular sectioned and resembling an orange segment in shape.
Excavation	An archaeological field method that involves the disturbance of the earth to reveal previously buried archaeological materials.
Exposure	An area of land surface where the ground surface is visible, usually as the result of either thinner vegetation cover, erosive forces or human-caused disturbance. In archaeological surveys, the percentage of ground surface that is visible is recorded. These percentages of exposure are then used to calculate effective coverage.

Feature	An artefact that cannot be normally removed from a site, e.g. foundations.
Fish Trap	A structure within a creek or river intended to guide fish or eels into a confined space for collected. Usually made with stone but may be formed from wood or reeds.
Flake	Any piece of stone struck off a core. It has a series of characteristics showing that it has been struck off. The most indicative of these features are ring cracks, showing where the hammer hit the core. Also the ventral surface may be deformed in characteristic fashion, for example having a bulb or eraillure.
Flaked Piece/Waste Flake	An unmodified and unused flake, usually the by product of tool manufacture or core preparation.
Fluvial	Pertaining to rivers and streams. Deposits by flowing water.
Grinding Groove	A depression formed in rock from the sharpening of a stone hatchet head or use of a muller (topstone).
Grinding Stone	The abrasive stone used to abrade another artefact or to process food.
Ground Edge Hatchet	A stone axe that is oval or round in shape and has edges formed by grinding and sharpening. Ground edge axes were hafted to wooden handles using resin, wax or a combination of material.
Ground Visibility	A term used to describe the area of the ground's surface that is visible during archaeological field surveys.
Hafting	The process of attaching a stone artefact onto a handle or spear.
Hammerstone	A stone that has been used to strike a core to remove a flake, often causing pitting or other wear on the stone's surface.
Hearth	Fireplace often recognised archaeologically through the presence of charcoal or burnt ground. Historical hearths are usually associated with a brick or stone structure.
Heritage	The word 'heritage' is commonly used to refer to our inheritance from the past. Heritage can be used to cover natural environment as well, for example the Natural Heritage Charter. In this document, cultural heritage refers to all Indigenous places and objects, and associated values, traditions, knowledge and cultures.
Holocene	The geological period covering the last 10,000 years.

Indurated Mudstone	Indurated mudstone (sometimes referred to as “tuff”) is a general term that encompasses sedimentary rocks from very fine mud-sized particles that are invisible to the naked eye that has been indurated with silica. The term may also encompass siltstones and claystones. Used to refer to a common type of stone used by Aboriginal people to make stone artefacts and generally sourced from the Hunter and Goulburn Rivers’ gravels.
In Situ	In the natural or original position. Applied to a rock, soil, or fossil when occurring in the situation in which it was originally formed or deposited.
***In situ* conservation**	Strategies and initiatives designed for the preservation and conservation of historical archaeological materials without the need to collect or excavate materials from their archaeological context.
Interpretation	A way of communicating meaning and relationships using original artefacts, by first-hand experience and by illustrations.
Entrenched creek	Refers to the deep trench naturally carved by a major watercourse usually through a low gradient area, and is distinct from gullied creeks which result from post-settlement creek erosion.
Isolated Find	A single artefact not located with any other.
Knapping	The process of striking rocks and causing them to fracture.
Landform Element	A small area of the landscape, assessed over an area of 30 m, with particular geomorphic attributes.
Lithics	Of, or pertaining to, stone.
Manuport	An object that is unmodified but has been transported to its location by humans.
Microlith	Small backed stone artefacts.
Midden	A deposit of occupation debris, rubbish, or other by-products of human activity.
Natural Transformation	Change in the archaeological record as a result of natural processes.
Object	See Aboriginal object.
Place	See Aboriginal place.

Pleistocene	The geological period equivalent to the last ice age and preceding the Holocene from about 2 million years to 10,000 years ago. The Late Pleistocene generally refers to the period of time from 40,000 – 10,000 years ago.
Post-depositional	After deposition. A term commonly used with reference to factors affecting the preservation of artefacts and archaeological features.
Quartz	A hard transparent mineral commonly used in the manufacture of stone artefacts.
Quartzite	A metamorphic siliceous rock commonly used in the manufacture of stone artefacts.
Retouched Flake	A flake that been flaked again in a manner that modifies an edge, commonly for the purpose of resharpening that edge.
Salvage Excavation	The archaeological excavation of a site conducted to obtain an example of the heritage values entailed within that site.
Scarred Tree	A tree that bears a scar or scars, which are wounds formed from a range of natural, accidental or deliberate impacts that cause damage to living plant tissue on a trunk or limb. See also *Aboriginal Scarred Tree*.
Scraper	A stone tool made on a flake or core with steep retouch along one or more edges.
Settlement Pattern	Distribution of human settlement on the landscape.
Significance	A term typically used in conjunction with the term 'heritage value' to define the level of importance of a heritage site or place.
Silcrete	A siliceous rock commonly used in the manufacture of stone artefacts.
Site	An area where archaeological evidence is observed.
Stone Arrangement	An arrangement of stones into a shape or pattern. Often used for ceremonial purposes or place markers.
Test Excavation	Excavation of small sections of an area to determine the archaeological remains and significance.
Toe-Hold	Small scar on the trunk and branches of a tree originally to facilitate climbing.
Tuff	Solidified volcanic ash. Used by some archaeologists to refer to indurated mudstone.

Tula	A flake with a prominent bulb, large platform and platform/ventral surface angle of about 130°, which is retouched at the distal end. Not to be confused with a tula adze.
Usewear	The wear displayed on an artefact as a result of its use.

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Executive Summary

Aboriginal heritage sites occur extensively along the major watercourses within the study area. Archaeological deposit containing buried Aboriginal heritage material potentially occurs across much of the flat area within 200 m of Saltwater Creek and its major tributaries.

A total of 47 Aboriginal sites and an extensive area of potential archaeological deposit occurs within the study area. Prior to the Aboriginal heritage assessment four Aboriginal sites had been recorded within the study area and several more close to its boundaries. In the course of archaeological survey an additional 43 Aboriginal stone artefact scatter sites were located predominantly on soil exposures next to creeks. Sites on elevated landforms or hillslopes occur with less frequency and comprise few artefacts in low density.

Areas of greatest significance occur in the southern flatter area alongside the heavily entrenched reaches of Saltwater Creek and its major tributaries. The large flat land associated with the major confluence of Saltwater Creek and the western tributary creek is of particular heritage value due to the significant research potential of archaeological deposits in the area.

Aboriginal heritage values identified to date within the study area are derived from the physical evidence of past Aboriginal activity. No non-tangible Aboriginal heritage values have been identified, although Aboriginal consultation continues in relation to the proposed development.

Aboriginal heritage values identified within the study area include:

- pre-contact Aboriginal activity evident in the widespread stone artefact evidence present within the topsoil in close association with creeks and some nearby slopes;
- a pre-contact landscape of high intensity Aboriginal activity associated with Saltwater Creek and its major tributaries and associated flat land distinct from low intensity activity in the upper reaches of creeks where creek margins are more inclined; and
- rare evidence of Aboriginal grinding tools in two sites.

Potential impacts from the proposed development include:

- impact from power station footprint to an areas of potential high value archaeological deposit in the southern flat area between Saltwater Creek and the western tributary creek; and
- impact from access road crossings over creeks to areas of potential archaeological deposit.

Many Aboriginal sites located more than 200 m from major creeks can be readily avoided by design of transmission tower footings and other infrastructure footprints.

The impacts to Aboriginal heritage will be mitigated through salvage excavation focussed on the area of highest significance within the area of the power station footprint. The area of archaeological salvage will be determined through test excavation prior to project approval. Other Aboriginal sites will be subject to a “collect and relocate” procedure whereby artefacts will be moved to adjacent area within the same landform and their revised locations recorded.

In recognition of the short EA preparation timeframe leading up to exhibition, the Director-General's Requirements for the EA did not require the ICCRs to be followed. Instead Aboriginal consultation followed two paths, with the initial archaeological survey and assessment conducted directly in consultation with Wanaruah Local Aboriginal Land Council to facilitate prompt fieldwork and reporting, while following the lengthy timeframes for each of ICCR consultation stages in parallel. This draft Aboriginal heritage as prepared for exhibition has been distributed to Aboriginal stakeholders identified through the ICCR process, but has yet to incorporate any comments because the ICCR timeframes have not yet expired for consideration of the draft report. As of mid-September 2009, verbal communications with Aboriginal stakeholders indicate satisfaction with the assessment of significance and management measures proposed in this draft EA. Written submissions and additional results of Aboriginal consultation will be incorporated in the final EA following the exhibition period.

1.0 Introduction

1.1 Background

Macquarie Generation (MacGen) owns and operates Liddell and Bayswater Power Stations between Singleton and Muswellbrook in the Upper Hunter Valley.

Liddell Power Station was commissioned during 1971 to 1973, and comprises four 500 Megawatt (MW) steam driven turbo-generators which use steam to generate electricity. A key feature of the Liddell Power Station is Lake Liddell, which has a surface area of some 1,133 hectares (ha) and was created as a cooling pond for the power station. Water is supplied to Lake Liddell by accessing high flow events in the Hunter River and local dam catchment inflows.

Bayswater Power Station was commissioned in the mid 1980s and comprises four 660 MW generating units. Electricity is generated by producing steam in coal-fired boilers, which is subsequently used under high pressure to drive turbo-generators. Cooling water for the Bayswater Power Station is supplied from the Hunter River from entitlements held in Glenbawn Dam. Plashett Dam is used to manage the receipt and distribution of water to both Bayswater and Lake Liddell.

MacGen is the Proponent for a Concept Application for a base load power station which may be coal or gas fired technology, on land within its ownership adjacent to the existing Bayswater Power Station (the proposed “Bayswater B” project). Fuel supplies would be delivered to the existing power station complex using existing and/or constructed infrastructure dependent on final design.

1.2 The Proponent

Macquarie Generation (MacGen) is a state owned corporation that owns and operates Bayswater and Liddell power stations between Singleton and Muswellbrook in the Upper Hunter Valley, NSW. MacGen operates under the *Energy Services Corporations Act* (1995) and the *State Owned Corporations Act* (1989) and was established on 1 March 1996.

If Concept Approval I granted by the NSW Minister for Planning, the site will be sold and the party who will design, construct and operate the Bayswater B facility would be required to complete any planning processes and undertaken environmental management considerations in accordance with the EA, Statement of Commitments, conditions of approval and the operating license.

1.3 Report

This report provides the heritage component for the environmental assessment being undertaken to assess the proposed development.

1.4 Study Area

The existing Bayswater Power Station site comprises approximately 1,200 ha of land and is located within the Muswellbrook Local Government Area (LGA) in NSW. It is noted that Plashett Dam, which is used as part of the existing power station operations, is located within the Singleton LGA.

The proposed project site is located to the west of the existing Bayswater Power Station, adjacent to Plashett Dam, on land owned by MacGen and within the Singleton LGA. The site is shown in **Figure F1** and **Figure F2.**

1.5 Objectives and Tasks

The objective of this assessment is to produce a report that identifies the Aboriginal and non Aboriginal archaeological cultural heritage values as well as areas of archaeological potential and constraints associated with the proposed construction of the Bayswater B2 Power Station. In order to meet these objectives, the following tasks were carried out:

- Identification of statutory requirements relevant to the project;
- Review of relevant State and Federal heritage registers and listings, including the Department of Environment, Climate Change and Water (DECCW – AHIMS register) and the Heritage Branch (Department of Planning – State Heritage Register);
- Review and collation of any existing documents including previous archaeological reports;
- Identification of the relevant Aboriginal stakeholders in accordance with the *National Parks & Wildlife Act 1974*: Part 6 Approvals – Interim Community Consultation Requirements for Applicants (ICCRs);
- Identification and assessment of any Aboriginal and non Aboriginal archaeological and cultural heritage values; and,
- field survey to locate any extant archaeological sites within the inspection area.

1.6 Project Team

The Project Team consists of archaeologists and other specialists from AECOM, and representatives from the Wanaruah Local Aboriginal Land Council. Neville Baker (Principal Archaeologist) directed the assessment, undertook fieldwork reviewed various report sections and wrote the significance assessment and heritage management commitments sections. Rick Bullers (Senior Archaeologist) managed the assessment, undertook fieldwork and co-wrote this report. Geordie Oakes (Archaeologist) conducted background research, undertook fieldwork, performed administrative tasks and co-wrote this report. Lee-Anne Bishop and Tim Osborne provided administrative and drafting support.

Representatives from Wanaruah Local Aboriginal Land Council who participated in field survey in July 2009 included Sarah Hall and Ricky McGrady.

1.7 Limitations

Within this report predictions have been made about the probability of subsurface archaeological materials occurring within the study area based on surface indications and environmental contexts. However, it is possible that materials may occur in areas without surface indications and in any environmental context.

AECOM undertook a search of the Aboriginal Heritage Information Management System (AHIMS) held by Department of Environment, Climate Change and Water (DECCW). Register searches are constrained by the amount of data in the register and the quality of that data (for example grid references can be inaccurate). Large areas of NSW may not have been systematically searched and may contain Aboriginal objects and other heritage values not recorded on AHIMS.

A summary of the statutory requirements regarding Aboriginal heritage is provided in **Section 0**. This is provided based on experience with the heritage system in NSW and does not purport to be legal advice. It should be noted that legislation, regulations and guidelines change over time, and users of the report should satisfy themselves that the statutory requirements have not changed since the report was written.

1.8 Report Structure

The report is structured as follows:

- **Section 0** provides the relevant government legislation and policy;
- **Section 3.0** discusses the project methodology;
- **Section 0** describes the methodology used for consultation with the Aboriginal stakeholder groups;
- **Section 0** provides environmental and archaeological contextual information;
- **Section 0** lists the Aboriginal sites and objects identified in the survey areas, and discusses the results of the field survey;
- **Section 0** discusses the significance values of the Aboriginal sites and objects identified in the study area;
- **Section** discusses the impacts of the proposed works on the heritage values identified in the study area; and,
- **Section 0** provides heritage management commitments.

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2.0 Applicable Policy and Legislation

2.1 New South Wales Legislation

The following New South Wales legislation protects aspects of cultural heritage and is relevant to development activities in the EA Boundary.

2.1.1 National Parks and Wildlife Act 1974

The *National Parks and Wildlife Act 1974*, administered by DECCW, is the primary legislation for the protection of Aboriginal cultural heritage in NSW. One of the objectives of the Act is:

> *The conservation of objects, places or features (including biological diversity) of cultural value within the landscape, including but not limited to: (i) places, objects and significance to Aboriginal people…* (s.2A(1)(b))

Part 6 of the Act provides specific protection for Aboriginal objects and places by making it an offence if impacts are not authorised. An Aboriginal Heritage Impact Permit (AHIP) should be obtained if impacts on Aboriginal objects and places are anticipated. AHIPs can be issued under ss.87 and 90 of the Act.

Sections 86 and 87

Under section 86 of the Act it is an offence to:

a) disturb or excavate any land, or causes any land to be disturbed or excavated, for the purpose of discovering an Aboriginal object; or

b) disturb or move on any land an Aboriginal object that is the property of the Crown, other than an Aboriginal object that is in the custody or under the control of the Australian Museum Trust.

…except in accordance with the terms and conditions of an AHIP issued under s.87 of the Act. DECCW policy and practice is to consider the following in determining an application for s.87 AHIP:

- the views of the Aboriginal community about the proposed activity;
- the objectives and justifications for the proposed activity;
- the appropriateness of the methodology to achieve the objectives of the proposed activity; and
- the knowledge, skills, and experience of the nominated person (s) to adequately undertake the proposed activity.

Section 90

Section 90 (1) of the Act states that:

> *A person who, without first obtaining the consent of the Director-General, knowingly destroys, defaces or damages, or knowingly causes or permits the destruction or defacement of or damage to, an Aboriginal object or Aboriginal place is guilty of an offence against this Act*

An AHIP issued under s.90 is required if impacts on Aboriginal objects and places are anticipated. An application for a s.90 AHIP must be submitted and approved by the Director-General of DECCW. DECCW policy and practice is to consider the following in determining an application for s.90 AHIP:

- the significance of the Aboriginal object(s) or place(s) subject to the proposed impacts;
- the effect of the proposed impacts and the mitigation measures proposed;
- the alternatives to the proposed impacts;
- the conservation outcomes that will be achieved if impact is permitted; and
- the outcomes of the Aboriginal community consultation regarding the proposed impact and conservation outcomes.

Section 5 of the Act define *Aboriginal object* and *Aboriginal place* as follows:

- An *Aboriginal object* means any deposit, object or material evidence (not being a handicraft made for sale) relating to the Aboriginal habitation of the area that comprises New South Wales, being habitation before or concurrent with (or both) the occupation of that area by persons of non-Aboriginal extraction, and includes Aboriginal remains; and
- An *Aboriginal place* means any place declared to be an Aboriginal place under section 84. [In effect this means a place declared so by the Minister administering the NPW Act because the place is or was of special significance to Aboriginal culture. It may or may not contain Aboriginal objects.]

Consultation with the Aboriginal communities is required under DECCW policy when an application for an approval under Part 6 is considered. The consultation process used in this study is outlined in more detail in **Section 4.0**.

Under s.75U of the Environmental Planning and Assessment Act, projects approved under Part 3A do not require a permit under s.87 or a consent under s.90 of the NPW Act. However, for the preparation of an Environmental Assessment, the Director-General of Planning will issue environmental assessment requirements under s.75F, in consultation with other relevant public authorities and have regard to the need for the requirement to assess any key issues raised by those public authorities.

2.1.2 Environmental Planning and Assessment Act 1979

The EP&A Act requires that consideration be given to environmental impacts as part of the land use planning process. In NSW environmental impacts are interpreted as including cultural heritage impact. Three parts of the EP&A Act are most relevant to Heritage. Part 3 relates to planning instruments, including those at local and regional levels; Part 4 controls development assessment processes; and Part 5 refers to approvals by determining authorities.

Part 3A provides an approvals regime applying to all major projects. Major projects are defined under State Environmental Planning Policy (Major Projects) 2005 (SEPP 2005). It also applies to those projects which the Minister believes are required to deliver particular government plans or programs, known as critical infrastructure projects. Part 3A applies to all projects where the Minister has the approval role. Under Part 3A, the Minister can issue a project approval or a concept approval. Both maintain the requirement for consultation with the community and relevant State Government agencies, however the requirement for certain other permits and licences is removed under Part 3A.

Section 75B(2) of the EP&A Act makes provision for 'major projects' to be identified through various means, including by way of declaration as a listed project in SEPP 2005, or by notice in the Gazette.

The Project is classified as a 'major project' under Part 3A of the Act.

2.2 Commonwealth Legislation

2.2.1 Aboriginal and Torres Strait Islander Heritage Protection Act 1984

The purpose of the *Aboriginal and Torres Strait Islander Heritage Protection Act 1984* (Heritage Protection Act) is the preservation and protection from injury or desecration of areas and objects in Australia and in Australian waters that are of particular significance to Aboriginal people in accordance with Aboriginal tradition.

Under the Heritage Protection Act the responsible Minister can make temporary or long-term declarations to protect areas and objects of significance under threat of injury or desecration. The Act can, in certain circumstances, override state and territory provisions, or it can be implemented in circumstances where state or territory provisions are lacking or are not enforced. The Act must be invoked by or on behalf of an Aboriginal or Torres Strait Islander or organisation.

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3.0 Methodology

This section describes the methodology used for conducting the Aboriginal heritage assessment.

The guiding principles for this assessment are

- The Director-General's Requirements issued for this project;
- the Aboriginal Cultural Heritage Standards and Guidelines Kit (NPWS 1997);
- the draft Guidelines for Aboriginal Cultural Heritage Impact Assessment and Community Consultation (DEC 2005); and
- the Part 3A EP&A Act Guidelines for Aboriginal Cultural Heritage Impact Assessment and Community Consultation (DEC/DoP 2007).

In order to achieve the objectives outlined in **Section 1.5**, the Aboriginal heritage assessment was divided into two broad tasks:

- to understand previously identified Aboriginal heritage values within the study area using desktop survey; and
- archaeological field survey of the study area; and
- Aboriginal consultation in accordance with the DGRs and following the 2005 guidelines.

3.1 Aboriginal Site Definition

3.1.1 Definitions Employed in this Assessment

An "Aboriginal site" is defined as the present-day location and extent of Aboriginal objects. An Aboriginal site is a place where an observer may see Aboriginal objects in the present. An Aboriginal site's boundaries will change as the extent of Aboriginal objects change. The extent of Aboriginal objects may change as erosion of an areas expands the area where Aboriginal artefacts have been uncovered from the soil. As a rule of thumb, artefacts within 50 m of each other may be classed as one site, but this rule is not derived from any coherent theoretical approach – it is simply a pragmatic device. The notion of "Aboriginal site" is not interpreted as what an Aboriginal person may have perceived as a good place to camp - the mind of the prehistoric Aboriginal person is not accessible to the modern day archaeologist. The notion of "Aboriginal site" is not interpreted as the extent of the landform or "archaeological terrain unit" (landform element divided into 3 slope classes) if artefacts are not observed to extend across that area.

"Archaeological Deposit" is the location of Aboriginal objects within the soil. The presence of archaeological deposit is inferred through observation of artefacts actively eroding from soil exposures and the reasonable informed inference of a continued presence of artefacts within an area defined by test excavation in the local area or defined by test excavation in analogous landforms in the region. Because archaeological deposit is, by definition, hidden, there is always a level of inference, however it must rely on positive relevant archaeological evidence. Archaeological deposit is where the archaeologist is confident of finding artefacts if they dig the ground. If a test excavation, comprising a systematic sample of 1 m² test pits within a landform element, results in a median score of 0 artefacts per test pit, then no archaeological deposit is defined.

"Potential Archaeological Deposit" (PAD) is the hypothesised presence of archaeological deposit where there is uncertainty due to lack of visible eroding artefacts, lack of test excavation either locally or in analogous areas in the region. PAD is where the archaeologist believes there may be deposit on a regional or even interregional basis but has not reliable local comparative basis. PAD may refer to the uncertain edges of archaeological deposit.

3.1.2 Comparison with other Definitions of Aboriginal Site

Several archaeological assessments in the Hunter Valley have used the concept of the "Archaeological Terrain Unit" (ATU). Kuskie is the main proponent of this approach and has defined the approach in his Mount Arthur North archaeological assessment report (1999). Kuskie defined an ATU as a landform element further divided into three slope classes. Landform element and slope are the two "important environmental attributes that are assumed to relate to the way in which Aboriginal people occupied the land." (1999:67). ATUs are "discrete, recurring areas of land for which it is assumed that the Aboriginal land use and resultant Aboriginal heritage evidence in one location may be extrapolated to others" (1999:67). Where an artefact is observed in any part of one ATU, then all of the ATU is regarded as an Aboriginal site. The location(s) of artefacts within the ATU are regarded as one locus or many loci. Even if these loci are more than 50 m apart, they are regarded as expressions of the one "site". Kuskie defines a "true cultural site" as evidence of an occupation that is spatially or temporally related (1999 59) occurring within an ATU.

The ATU definition of a site can results in the flat conclusion that the entire study area is a connected mosaic of sites without any non-site areas. This simply confirms the truism that Aboriginal people have previously lived in all parts of the land.

The ATU approach places the emphasis on defining landscape as site. This approach moves well beyond treating landscape as a context for interpreting the patterned distribution of Aboriginal heritage material. This has resulted in questionable outcomes of management areas defined on the basis of landscape alone without reference to the significance of Aboriginal heritage material contained within the landscape. Furthermore, attempts to replicate the ATU approach by Umwelt at Mt Arthur Coal (2007, 2008) have resulted in varying "site" definitions and inexact bases for comparison.

3.2 Desktop Survey

The desktop survey methodology comprised:

- a search of the DECCW AHIMS Aboriginal sites database prior to field survey (**Section 5.3.3, Appendix A**);
- a search of historic heritage databases including (Section 5.3.4, Appendix B);
  - the Australian Heritage Database (comprised of the Register of the National Estate (RNE), the Commonwealth heritage List (CHL), National Heritage List (NHL) and World heritage List (WHL); and
  - The NSW Heritage Database (comprised of the State Heritage Register (SHR), and lists maintained by State Government Agencies and Local Councils.
- desktop review of previous archaeological and heritage reports relevant to the regional and local area (**Section 5.3**);

- consultation with the local Aboriginal community in a two-stage process:
  - initially via the Wanaruah Local Aboriginal Land Council in July 2009
  - subsequently with Aboriginal parties identified via the Interim Community Consultation Requirements (DEC 2004) process which continues beyond the preparation of this report (**Section 0**);
- review of landscape character and landuse history which influences patterning of sites (**Section 0**); and
- assessment of impacts on the Aboriginal heritage values of the study area (**Section**).

3.3 Fieldwork Design

The method used for the field survey included dividing the survey areas into a series of discrete land-form based areas and placing transects within each landform area (**Figure F3**). This is in accordance with guidelines within *Aboriginal Cultural Heritage Standards and Guidelines* (NPWS 1997). To achieve this, the landscape was divided into morphological landform elements (see **Section 3.3.1**). This allowed planning for all landforms to be sampled within the study area. Due to the nature of the terrain, one hundred percent survey coverage was not considered feasible and representative areas within each terrain unit were sampled. Furthermore, it must be emphasised that the effective coverage achieved is poor due to the presence of long grass or other vegetation/ground surface cover that inhibits observation of the ground surface and therefore any artefacts lying on the ground.

The fieldwork involved a combination of pedestrian and vehicle-based surveys. Pedestrian surveys were conducted in areas of steep, highly eroded and/or heavily vegetated terrain, with archaeologists and Aboriginal community representatives walking in line abreast at approximately 5 m intervals. In areas of flat, open terrain, where visibility was extremely poor due to pasture grasses, vehicle transects were adopted. Vehicles were used to traverse backwards and forwards across the paddocks and stop at all exposures and at locations considered to have the highest potential for Aboriginal sites.

Notes on landform, soils and surface exposure were recorded. Records consisted of descriptive notes, Differential Global Positioning System[1] (DGPS) positions (MGA format), and photographs. Where artefact scatters were recorded, the position of each artefact in most sites was recorded using DGPS. Polygons were established for site boundaries and the centre position of the site recorded as the site location for site card preparation.

This survey strategy is comparable to other major surveys undertaken at nearby Mt Arthur Coal (Kuskie 1999; Kuskie and Clarke 2004; Umwelt 2007; Umwelt 2008, AECOM 2009), except that those surveys divided the landscape into broader 'archaeological terrain units'[2], whilst this study used the more conventional 'landform elements' (after McDonald et.al. 1998).

A survey methodology was sent to registered Aboriginal stakeholder groups for their input into the planning process (further detail provided in **Section 0**).

[1] Trimble GEO-XM, employing GPS Pathfinder Office software.

[2] Kuskie (1999: 67) defined ATUs "… on the basis of two important environmental attributes, that are assumed to relate to the way in which Aboriginal people occupied the land. These are discrete, recurring areas of land for which it is assumed that Aboriginal land use and resultant heritage evidence in one location may be extrapolated to other similar locations." The two environmental attributes are landscape elements and class of slope.

3.3.1 Landform Elements

In order to ensure that an adequate sampling of landform elements was conducted during the fieldwork, a landscape morphological map of the study area was prepared. This entailed dividing the landscape into discreet landform elements based on topographic contours. The morphological map was devised prior to the survey in order to develop the survey strategy in conjunction with the predictive model (**Section 5.3.5**). The landscape elements were also used as a means of calculating effective cover (**Section 1.0**). An assessment of effective coverage is a quantifiable estimate of the area in which archaeological materials are "detectable", i.e. exposed ground surface area.

Landform elements within the survey area were recorded for both individual sites and for transects. These records assist in interpreting archaeological site patterning and, consequently, Aboriginal occupation throughout the landscape of the study area. It is also important for comparative purposes with previous survey areas in the wider Upper Hunter Valley region. **Table 1** identifies the landform elements that were recorded in the survey area.

The landform elements are based on McDonald et al's (1998: 13-19) morphological units. The distribution of landform elements in the survey area is shown in **Figure F4**.

Table 1: Landform Elements Identified in the Survey Area

Landform Element	Description
Ridgeline	A smoothly convex landform that stands above almost all points in the adjacent terrain. A ridgeline consists of a narrow crest with short adjoining slopes where the crest length is greater than the crest width. The ridgelines within the survey area consist of crests and saddles (refer below).
Spur	A smoothly convex landform that stands above all or almost all of the adjacent terrain and runs off a ridgeline.
Spur (secondary)	A spur that runs off a spur.
Spur Crest	An elongated crest that runs from a ridge crest.
Saddle	A saddle is an area that occurs between two higher points (crests) along the spur.
Upper-slope	Slope element adjacent to and below a crest. This landform is not buried by colluvial deposit and is above the mid-slope.
Mid-slope	Slope element lying between the upper-slope and lower-slope.
Lower-slope	A waning slope, below a mid-slope and above a footslope.
Bench	A short, gently or very gently inclined mid-slope element eroded or aggraded by an agent.
Hillock	A compound landform element comprising a narrow crest and short adjoining slopes, the crest length being less than the crest width.
Floodplain	A flat of gently inclined area associated with a stream channel. There may be active erosion and/or aggradation by channelled and over-bank stream flow.
Creek line	The channel of a creek/watercourse.
Flat	A planar landform that is neither a crest nor a depression and is level or very gently inclined (less than 3% tangent approximately).

3.3.2 Fieldwork Timing and Personnel

The fieldwork was conducted in two phases:

1 *Phase 1*: an initial site inspection was conducted over a three-day period on 8-10 July 2009 by two AECOM archaeologists (Rick Bullers and Geordie Oakes); and

2 *Phase 2*: a field survey was conducted on 29-31 July 2009 by two AECOM archaeologists (Neville Baker and Geordie Oakes), assisted by representatives of the Wanaruah Local Aboriginal Land Council (Sarah Hall and Ricky McGrady).

Aboriginal consultation is ongoing at the time of preparing this report due to the short preparation timeframe to which AECOM is working. An on-site meeting is proposed for Aboriginal stakeholders.

3.3.3 Specific Actions for Fieldwork

The methodology comprised:

- field survey over a six day period by AECOM archaeologists Neville Baker (3 days), Rick Bullers (3 days) and Geordie Oakes (6 days), with members of the local Aboriginal community. The survey covered transects of 10-50 m width, sampling each of the landform elements identified for the study area ;
- recording and significance assessment of any heritage sites or items located during the survey (to the extent possible from surface evidence);
- careful inspection of all ground exposures for evidence of artefacts;
- recording of details of the survey using field notes and DGPS, including survey tracks (transects - **Appendix D**), individual artefacts within most sites, some exposures, site locations. These were used to develop maps to guide fieldwork;
- use of DECCW site cards as guidance, along with DGPS, to relocate previously recorded sites;
- inspection of sandstone outcrops within the survey areas (or immediately adjacent) for axe grinding grooves;
- inspection of mature trees within the survey areas (or immediately adjacent) for evidence of scars; and
- photographing the survey areas and noting environmental and archaeological aspects.

3.4 Consultation Methodology

Archaeologists often focus on the material evidence of human occupation. It should be noted, however, that the concept of Aboriginal heritage is not confined to material evidence, i.e. archaeological sites. Instead, it is much broader in scope, encompassing such factors as language, stories and ritual. To investigate Aboriginal heritage values not related to archaeological sites, the local Aboriginal community was consulted.

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4.0 Aboriginal Community Consultation

Aboriginal Stakeholder Consultation was conducted in accordance with the *National Parks & Wildlife Act 1974*: Part 6 Approvals – Interim Community Consultation Requirements for Applicants (ICCRs) and is documented in a consultation log included at **Appendix E**.

In recognition of the short EA preparation timeframe leading up to exhibition, the Director-General's Requirements for the EA did not require the ICCRs to be followed. Instead Aboriginal consultation followed two paths, with the initial archaeological survey and assessment conducted directly in consultation with Wanaruah Local Aboriginal Land Council to facilitate prompt fieldwork and reporting, while following the lengthy timeframes for each of ICCR consultation stages in parallel. This draft Aboriginal heritage as prepared for exhibition has been distributed to Aboriginal stakeholders identified through the ICCR process, but has yet to incorporate any comments because the ICCR timeframes have not yet expired for consideration of the draft report. As of mid-September 2009, verbal communications with Aboriginal stakeholders indicate satisfaction with the assessment of significance and management measures proposed in this draft EA. Written submissions and additional results of Aboriginal consultation will be incorporated in the final EA following the exhibition period.

A newspaper advertisement (**Appendix F)** was placed in the Hunter Valley News on the 13th July 2009 seeking registrations of interest from local community groups who wished to be consulted for the assessment. As a result of the advertisement the following community groups registered interest:

- Wanaruah Local Aboriginal Land Council;
- Aboriginal Native Title Consultants;
- Hunter Valley Culture Consultants;
- Upper Hunter Heritage Consultants;
- Yinarr Cultural Services;
- Wanaruah Custodians Aboriginal Corporation; and
- Ungooroo Aboriginal Corporation.

In addition to placing an advertisement in the local newspaper various government organisations were contacted seeking known local stakeholder groups who may wish to be consulted in the assessment. Stakeholder groups identified by these organisations were sent a letter inviting registration. The following stakeholder groups subsequently registered interest in consultation for the assessment:

- Giwiir Consultants;
- Culturally Aware; and
- Wattaka Wonnarua Cultural Consultancy Services

Groups registered at this stage of the project were sent a copy of the field methodology by mail for comment. No comments were received by AECOM in response to the methodology.

A stakeholder meeting and site walkover was held on 9 September 2009 at Bayswater Power Station. A powerpoint presentation was discussed including the Aboriginal sites identified, the Potential Archaeological deposit identified, the scientific significance assessment, the proposal for test excavation and salvage excavation, and an explicit request for the community to discuss or communicate Aboriginal heritage values of the land other than the physical evidence of archaeological sites.

Representatives of all the groups listed above attended, with the exception of Wanaruah Custodians and Ungooroo Aboriginal Corporation. In additional to those listed above, representatives of the following groups arrived at, and were and were involved in the meeting:

- Hunter Valley Cultural Surveying (Luke Hickey); and
- Mingga Consutlants (Clifford Matthews).

A copy of the draft report was distributed by hand to each of the attendees and mailed to those Aboriginal Stakeholders that did not attend.

Feedback from Aboriginal stakeholders will be updated in **Appendix G** when received.

5.0 Background

5.1 Environmental Context

5.1.1 Climate

The prevailing climate in the area is warm and temperate with a continental influence. Summers are warm to hot and humid, winters are cool to mild. The maximum mean temperatures occur during the summer months with January being the hottest month (31.7ºC). Winter is the coolest time of the year with a minimum mean temperature of 3.8ºC occurring in July. The average maximum temperatures for this area range between 30.9 to 31.7ºC in summer and 17.4 to 22.8ºC in winter, although daily temperatures can reach considerably higher or lower than this. The average annual rainfall for this area is 640 mm (Bureau of Meteorology 2009).

5.1.2 Topography

The landscape of the site consists of slightly undulating low hills on Permian sediments that form part of the Liddell soil landscape, characterised as Relief 60-120 m, Elevation <200 m and Slopes 4-7%.

The study area lies within the Central Lowlands land system within the Hunter River Valley. The topography of the Central Lowlands is characterised by undulating low hills with scattered undulating hills, ranging in elevation from 140 - 330 m. Slopes range between 3 - 7% (Kovac & Lawrie 1991). Hughes (1985) describes Central Lowlands topography as follows:

> *"Through the centre of the Hunter Valley there is a belt of lowlands developed on relatively weak sedimentary rocks. These lowlands continue down to the coast. While the general altitude gradually rises inland from sea level to 500 m at Murrurundi, the local relief in any one locality rarely exceeds 60 m. The landscape is undulating or gently hilly with an abrupt transition to the steep country on either side. A line of alluvial flats between 0.5 and 2.5 km wide extends along the Hunter River and its major tributaries where they flow through the lowland belt."*

The study area consists of a number of low hills, and a larger hill in the north west of the study area. In the southern part of the study area flat to very gently inclined areas are found associated with Saltwater Creek and its major tributaries, including the large western tributary creek and eastern tributary creek as shown in **Figure F4**.

5.1.3 Geology and Soils

For the most part soils have the typical duplex structure of topsoil over clay subsoil. Observations of soil exposures along creeks confirm their high erodibility. The soils are comprised of shallow to moderate, moderately well-drained yellow Soloths and yellow Solodic Soils on slopes, with some Earthy and Siliceous Sands, red Soloths, red Solodic Soils and red Podzolic soils in the landscape as detailed in **Chapter 17** of the EA.

The predominant soil landscape in the study area is the Liddell soil landscape. The Liddell soil landscape lies on the Singleton Coal Measures which consists of lithic sandstone, shale, mudstone, conglomerate, siltstone and coal seams. In addition, the Brays Hill soil landscape occupies the north east corner of the study area. The Brays Hill soil landscape lies on the Singleton Coal measures and Tertiary basalt consisting of calcareous shale, sandstone, and basalt.

5.1.3.1 Liddell Soil Landscape (ld)

This soil landscape occurs across the majority of the study area, including undulating hills, on alluvial creek flats and stream channels. Soils are generally duplex in character with varying degrees of change between A and B horizons. Lower-slopes are comprised of Yellow Solodic Soils, which consist of weakly structured dark brown loam A_1 horizons over bleached orange clay loam A_2 over a clearly changed, blocky bright reddish brown light clay, becoming more yellow at depth.

Mid-slopes are comprised of Earthy/Siliceous Sands, which consist of brown sand/loamy sand to brown sandy loams, gradually changing to dull yellow-brown sandy loam or bright brown loamy sand in the B horizon. Upper-slopes are comprised of Yellow Soloths, which consist of Brown loamy sand to sandy loam over a bleached light grey/yellow orange sandy loam or sandy clay loam, clearly changing to bright brown/dull orange sandy clay in the B horizon.

Soils on the lower and upper-slopes (Soloths and Solodics) are susceptible to moderate to high erosion, particularly sheet, gully and, to a lesser extent, rill erosion. Soils on the mid-slopes (Sands) have a low potential for erosion. Mass movement hazard is low throughout the soil landscape.

5.1.3.2 Brays Hill Soil Landscape (br)

This soil landscape occurs in the north east of the study area. The soil landscape is comprised of a variety of soil types, all either gradually or sharply duplex in character. Soils are alluvial layered clays in the drainage lines, Yellow Solodic Soils on lower to mid-slopes or Grey Clays/Brown Clays or Red Clays on mid-slopes, Black Earths on mid to upper-slopes and Red-brown Earths on upper-slopes and crests.

Soil erodibility varies from low to moderate throughout the soil landscape, although Alluvial subsoils have a high level of erodibility. Soils on cleared hillslopes are susceptible to minor sheet erosion and drainage lines may have moderate gullying. Gilgai depressions with Red and Grey Clays may have minor rilling. Potential for mass movement is moderate to low.

5.1.4 Vegetation

Vegetation in the Central Lowlands comprises rainforest and eucalyptus dominated communities and grassland. Prior to European settlement studies have shown areas of undulating hills and flood plains in the Upper Hunter were lightly timbered, predominately with Ironbark Gum and Box, and also well grassed. The banks of major rivers and large creeks were thought to be thickly treed, mainly with swamp oaks (Hughes 2004). This vegetation environment, which can still be found in some isolated areas of the Hunter Valley, was likely the result of Aboriginal land use strategies employed over the past 10 000 years. European intervention has modified the vegetation of the Hunter Valley further, especially as a result of large scale clearing for grazing and open cut mining activity. Clearing has created an artificial grassland over much of the Central Lowlands and consigned trees to thin strips along creek banks.

Much of the study area is completely cleared and covered with dense pasture grass which in July 2009 was over 1 m height in most areas. Woodland vegetation occurs between Saltwater Creek and the current Bayswater power station.

5.1.5 Fauna

The Atlas of NSW Wildlife lists 166 fauna species located within a 10 x 10 km search area centred on the study area, including nine species of amphibians, 17 species of reptiles, 35 species of mammal and 105 species of birds. Of these, nine mammal species and six bird species were introduced since European settlement and were not available to Aboriginal hunter-gatherers as a possible food source.

Fauna surveys were conducted during assessments for the Mount Arthur Coal colliery directly north of the study area by Umwelt (2007, 2008). **Table 2** lists fauna species that were identified within the area which are known, from ethnographic sources, to have been hunted by Aboriginal people.

Table 2: Aboriginal Prey Species in the Region

Class	Common Name	Scientific Name
Amphibia	turtle	*Chelodina* sp.
Mammalia	eastern grey kangaroo	*Macropus giganteus*
	common wallaroo	*Macropus robustus*
	red-necked wallaby	*Macropus rufogriseus*
	brush-tailed rock wallaby	*Petrogale penicillata*
	swamp wallaby	*Wallabia bicolour*
	sugar glider	*Petaurus breviceps*
	squirrel glider	*Petaurus norfolcensis*
	common ringtail possum	*Pseudocheirus peregrinus*
	common brushtail possum	*Trichosurus vulpecular*
Reptilia	red-bellied black snake	*Pseudechis porphyriacus*
	red-naped snake	*Furina diadema*
	lace monitor	*Varanus varius*
Aves	stubble quail	*Coturnix pectoralis*
	black swan	*Cygnus atratus*
	Australian wood duck	*Chenonnetta jubata*
	Pacific black duck	*Anas superciliosa*
	grey teal	*Anas gracilis*
	hardhead (duck)	*Aythya australis*
	Australasian grebe	*Tachybaptus novaehollandie*
	dusky moorhen	*Gallinula tenebrosa*
	Eurasian coot	*Fulica atra*
	masked lapwing	*Vanellus miles*
	crested pigeon	*Ocyphaps lophotes*
Fish	eel	*Anguilladae* sp.

Source: NSW Wildlife Atlas; Umwelt 2007, 2008.

5.1.6 Drainage

A number of watercourses traverse the study area. The principal watercourses are Saltwater Creek and an un-named creek (referred to as western tributary creek in this report). These two creeks border the main part of the study area to the east and the west respectively. Saltwater Creek and its tributaries wind their way from the northern extent and on the western side of the study area to join the western tributary creek in the south where they feed into Plashett Dam (**Figure F2**).

Although much smaller in extent than Saltwater Creek, the western tributary creek forms the western border of the study area and again runs in a southerly direction into Plashett Dam.

Both watercourses have been subject to considerable bank and bed erosion initiated by gullying. Saltwater Creek is deeply entrenched in some sections up to 10-20 m depth. In places Saltwater Creek's bed is entrenched so deeply as to expose volcanic bedrock.

In the past saltwater Creek and it major tributaries would have provided reliable sources of water in deep waterholes and also been home to a range of aquatic plant and animal resources.

Four gently inclined drainage depressions of various lengths cut across the study area from east to west. These are characterised by moderately inclined side slopes and minor erosion in places. The drainage depressions are largely covered in pasture grass with no water present. However, during rains water likely flows along these before feeding into Saltwater Creek and on to Plashett Dam.

5.1.7 Past Environmental Conditions

The landscape of the Hunter Valley has undergone a number of environmental changes during the past 40 000 years. These changes were the result of alterations in climactic conditions, starting with the wet, cool 'pluvial' period up to about 40 000 years ago, followed by the long, cold, dry glacial maximum of about 17 000 years ago. These colder and drier conditions may have been accompanied by widespread landscape instability, reflected in the stripping of soils from hillslopes and major geomorphic events along stream valleys (Hughes 2004: 16).

Temperatures began to rise from about 17 000 years ago reaching those similar to today during the Holocene (c. 10 000 BP). As temperatures increased the availability of water and resources were subsequently affected as were the nature and flow of the regions watercourses. Estuarine conditions may have increased or decreased impacting on the subsistence patterns and social organisations of local populations.

During the Holocene the landscape of the Upper Hunter and the resources available to Aboriginal inhabitants are believed to be similar to those encountered by European settlers in the late 1700s (Hughes 2004: 16).

5.1.8 Land Disturbance

The Hunter Valley has been subject to considerable landscape modification since European settlement. Much of this is a result of European farming techniques, but also from activities associated with coal mining. A combination of these activities has had a significant effect on the vegetation and fauna, watercourses and the landform of Hunter Valley.

A consequence of these past land use practices has been the disturbance to archaeological sites, specifically affecting the potential for identifying and locating Aboriginal archaeological deposits and material, and the kinds of information those deposits may offer archaeologists. For example, vegetation clearance may result in the destruction of scarred or carved trees and can exacerbate erosion (particularly sheet and gully erosion). Erosion may transport archaeological material away from its original site of deposition, thus removing much contextual information. On the other hand, erosion may also result in uncovering archaeological deposits and an increase in ground surface visibility in some areas; thus artefacts may be found where they might otherwise have remained undetected.

The greatest impact to the landscape of the Hunter Valley has been from large scale clearance of native vegetation, particularly along drainage lines, in order to create pasture land for grazing. This began in the early 1820s when the Hunter Valley was opened for settlement and continued into the 20th century. Settlers typically moved from existing settlements in Newcastle or travelled overland from Sydney to establish new settlements. The best agricultural land was granted in a period from 1823-1827 when approximately 25% of the land was converted to freehold title by grant. The initial pattern was for freehold estates to be established along the major tributaries of the Hunter and for the Crown Land in between to be grazed (legally or by squatting). These estates formed the base for squatting settlement of the Liverpool Plains and New England.

Muswellbrook (or Muscle Brook as it was then called) was first visited by European settlers during the early Colonial period by Chief Constable John Howe in 1819. Major parcels of land were subsequently surveyed by Henry Dangar along the banks of the Hunter River for allocation to early settlers by 1824. The rich soils surveyed by Dangar resulted in Muswellbrook being established as a farming centre, with the well known settlements of James Bowman, Robert Lethbridge and William Oglivie all appearing by 1826 in the general vicinity. The first railway was completed in 1869 and the town experienced significant expansion within this period.

The impact of these pastoral establishments on the environment was initially comparatively minor as they were largely grazing sheep and cattle, and cropping was found lower down in the Valley on the flats near Maitland. There was, however, some impact from the construction of infrastructure such as fences, houses and farm buildings and small gardens to supply farm workers.

Major clearing would have occurred after the land was subdivided in the 1830s. The primary impact of clearing is likely to have been erosion and changes to hydrology as more sediment was dumped into the system. It is likely, as Prosser (1992) argues; impacts would build up with little apparent evidence of change followed by a single catastrophic event during which there would be a period of rapid erosion and degradation. The erosion would continue unless the catchment reached equilibrium.

The general area around Muswellbrook was developed into small dairy farms of probably 50-150 acres supplying dairy factories in the major towns such as Muswellbrook or Singleton. After the First World War the larger properties were broken up into smaller farms with dairying supplanting wool and wheat. Dairying came to replace wool and grazing for meat as the main rural industry.

The extent of the impact of 170 years of post-contact settlement on Aboriginal sites is an important question. The major impact would probably have been on carved and scarred trees, which would have been removed as part of clearing. However, the experience from other parts of the Hunter is that many Aboriginal sites survive long periods of sustained grazing provided that erosion is controlled.

Construction of infrastructure such as buildings, earthworks, roads, and railways is likely to have had an impact on any Aboriginal sites in their vicinity, but some of these impacts may be superficial as the actual impact on the ground may be comparatively small and shallow.

While not as great as the effect of land clearance for grazing, within the past half-century, open cut coal mining has, arguably, created the greatest source of disturbance to the Hunter Valley landscape and often resulted in the destruction of archaeological sites that occur on the affected land. However, conservation offsets have been established to offset the disturbance to Aboriginal heritage values.

5.1.9 Summary of Environmental Conditions and Implications for Aboriginal Archaeology

Although the current flora and fauna inhabiting the study area are not necessarily representative of the range and quantity present prior to non-Indigenous settlement, the composition of flora and fauna species present in modern times are indicative that there were probably sufficient resources to support small groups of hunter-gatherers.

The soils are not generally prone to high degrees of erodibility and potential for mass movement is also low to moderate. Therefore, the potential for movement of subsurface Aboriginal artefacts within soils, followed by secondary deposition as "lag" deposits, is considered to be fairly low. However, loss of any soil has the potential to reduce the integrity of a site and therefore lower its scientific significance.

5.2 Aboriginal People in the Region

Prior to European settlement, the Muswellbrook district was inhabited by people of the Wonnarua language group (many spelling variations include Wanaruwa, Wanarua, Wannarawa, Wannerawa, Wonarua, Wonnah Kuah, Wonnuaruah). This language group covered a relatively small area of some 5,200 km^2 which, according to Tindale (1974: map supplements), straddled the Upper Hunter Valley and extended from just west of Maitland and Kurri Kurri west to the Dividing Range (just west of Widden Brook). The Wonnarua's lands border the Darkinjung territory to the south near Wollombi, the Worimi and Awabakal of the Lower Hunter to the east near Maitland, and the Geawegal to the north near Muswellbrook.

The area of proposed development lies near the northern limits of the Wonnarua's territory and therefore the area may also have been influenced by the neighbouring Geawegal group to the north. According to Brayshaw (1987: 38) both the Wonnarua and the Geawegal were closely affiliated with the Kamilaroi people of the Liverpool Plains. Indeed, Brayshaw (1984) concludes that the Kamilaroi were the dominant cultural influence throughout the Upper Hunter region. Their social systems covered both the Goulburn Valley and Hunter Valley as far south as Wollombi Brook. Brayshaw (1987: 51) considers that the Wonnarua, Geawegal and probably the Gringai (Worimi) were all part of the "Kamilaroi Nation."

The Wonnarua peoples social structure was comprised of many self-governing units consisting of the smallest residential units known as 'hearth groups' of perhaps 10 people consisting of a man, his wife or wives and their dependent children. Several hearth-groups camped together temporarily forming slightly larger residential units called bands of perhaps 40-60 people (Lourandos 1977). The largest residential groupings consisted of either seasonal (summer) band aggregations or irregular ceremonial band aggregations forming local 'communities' of at least 150 people.

Spiritual authority was vested in a large number of supernatural beings. One of the most important was *Baiami* ('The Great Shaper,' 'Thunder-God' or 'Great One'). Baiami formed the world by shaping the cosmos from a pre-existing primeval void (O'Rourke 1997: 173). Society was divided into two matrilineal moieties and based their political organisation on a council of Elders (Djekic 1984: 2).

A variety of foods, particularly animals, were consumed. Unlike other areas of Australia, plant foods were not as readily consumed except for grass-seed, especially in the form of seed-cakes. Kangaroo grass, as well as other grass types, was gathered in large quantities and ground between flat stones and baked in hot ovens (Gardiner, cited in O'Rourke 1997:150-154) and this is demonstrated archaeologically by the presence of grinding stones at the Moore Creek complex near Tamworth (McBryde 1977). The people of the lower slopes and plains were known to erect complex huts of grass and tree branches, or grass and mud over a frame of boughs (Allen, cited in O'Rouke 1997: 148). These huts were often erected in large, semi-permanent summer camps, especially along river margins of the plains country. These communities usually dispersed into the smaller hearth-groups during winter.

The population density for the Wonnarua is difficult to estimate, and certainly pre-European numbers have not been estimated with any accuracy. Various historical accounts of early European interactions with the Wonnarua, cited by Brayshaw (1987: 46-48), suggest relatively low numbers for that language group. For example, five individuals were observed by John Howe near Jerry's Plains in 1819. In 1824 fifteen Aborigines visited Dangar's camp at Dart Brook and soon after a group of 150 attacked his party just beyond the Liverpool Range. These figures tend to correlate with the population numbers based on the social groupings discussed above. However Brayshaw (1987: 47) suggests that actual numbers were higher than this with reports of groups of 200 and 300 able-bodied men observed in separate groups. Curr (1886: 352) stated that the Wonnarua numbered 500 individuals in 1841, but by the 1880s population numbers had seriously declined, citing various diseases as the principal cause.

Present-day descendents of the Wonnarua live throughout the Hunter Valley region and take a deep pride in their cultural heritage.

5.3 Archaeological Context

5.3.1 Hunter Valley Archaeology

Several regional Aboriginal archaeological studies have been undertaken in the Hunter Valley over the past 25 years. These include Hughes (1984), Koettig *et al* (1990), and ERM (2004).

Hughes PJ. 1984. *Hunter Valley Region Archaeology Project Stage 1, Volume 1 – An Overview of the Archaeology of the Hunter Valley, its Environment Setting and Impact of Development (cited in Koettig 1990 & ERM 2004)*. Hughes undertook a review of the archaeological data for the Hunter Valley available in 1984 and found most archaeological investigations had been concentrated in the Central Lowlands. The result of Hughes' investigation found that Aboriginal archaeological sites are located across the whole of the Hunter Valley and consist of a variety of site types. Sites in the Central Lowlands are characterised by open campsites which are consistently found in areas up to 50 m away from watercourses, irrespective of their size. However, site sizes are seen to diminish as the size of watercourse decreases. Sites were found to occur on hills and slopes although they are relatively sparse. Hughes found that archaeological evidence does not appear to be older than approximately the mid-late Holocene.

Burton C, Koettig M & Thorp W. 1990. *Regional Study of Heritage Significance Central Lowlands Hunter Valley Electricity Commission Holdings.* The authors were commissioned by the Electricity Commission of NSW to assess the heritage significance of the natural landscape, and the historic and Aboriginal archaeology within their holdings in the Hunter Valley. The report provides a summary and review of known Aboriginal sites in the Hunter Valley Region. Similar to Hughes' (1984) the results of this study found that most Aboriginal archaeological sites are found to be in the Central Lowlands, however, this is explained as being due to continued development being undertaken in the region. The study found a total of 195 sites had been recorded since Hughes' review six years prior. Of these, 191 were open artefact scatters, two 'possible' scarred trees, one definite scarred tree and one set of grinding groves. The majority of artefact scatters recorded were located in the A soil horizon and the surface of the eroding B horizon. Radiocarbon dating was undertaken from two charcoal samples found at a depth of one metre at a hearth site were dated at + 20 000, indicating that Aboriginal occupation commenced in the area by at least the Late Pleistocene.

ERM 2004. *Upper Hunter Valley Aboriginal Baseline Study for Upper Hunter Aboriginal Heritage Trust.* The report gives a synthesis of the work that has been done in the Upper Hunter up until 2004. The report notes that the majority of sites reviewed (over 98%) are open sites with surface scatters of stone artefacts. These are concentrated along the major creeks flowing into the Hunter River and its tributaries. Sites are found to occur wherever erosion has removed some of the topsoil, however they are much more likely to occur, and artefact densities are likely to be greater, near creek lines than on the slopes or ridge crests. Sites are also noted as increasingly being identified in aeolian sand deposits. Most sites comprise of flaked stone artefacts of silcrete and indurated mudstone/tuff with minor components of quartz, petrified wood, chalcedony, porcellanite and other igneous rocks. Backed artefacts typically make up 1% or 2% of an assemblage. Sites along creeklines generally have potential for subsurface deposit. The significant potential for deep Pleistocene archaeological deposits in aeolian dunes and sand-sheets is discussed.

5.3.2 Local Archaeological Context

In order to develop a predictive model of site location, distribution and type that occur in the study area it is necessary to review the archaeological work that has previously been undertaken in that environment. A number of assessments have been carried out in the vicinity of the study area. The most relevant of these assessments have been summarised below:

Dyall LK. 1977. *Environmental Studies – Mt Arthur Project (Hunter Valley).* Dyall undertook a survey for the Electricity Commission of NSW into areas south and west of the Bayswater Colliery. A number of sites were located and collected along Whites Creek (37-2-23, 37-2-25). These consisted of Artefact Scatters numbering into hundreds of artefacts. In 1980 Dyall re-examined Whites Creek in the course of an EIS on the Mount Arthur North coal lease. Parts of sites 37-2-25 were divided into two sites, 37-2-114 and 37-2-115.

Dyall LK. 1980. *Aboriginal Relics on the Drayton Coal Lease, Muswellbrook.* Dyall undertook a survey of an area immediately south of the Bayswater Colliery and north of the study area. Three sites were recorded on the banks of Saddlers Creek. The sites contained flakes, cores and backed blades of chert, rhyolite and quartz.

Dyall LK. 1981. *Report on Aboriginal Relics from Mt Arthur South Coal Lease***.** Dyall undertook a survey for Mount Arthur Coal of an area immediately south of Mount Arthur. The area, leased by Mount Arthur Coal, was surveyed in anticipation of it being open cut mined. A total of 24 open campsites were found along creeklines (Saltwater and Saddlers) within the lease area. Two of the sites were large, containing more than 500 stone flakes scattered on the ground surface. Artefact types included stone implements such backed blades, stone axes, choppers and grinding slabs. Other artefact types included waste flakes, and flaking cores.

Dyall LK. 1981. *Environmental studies – Mt Arthur Project (Hunter Valley): full report on Aboriginal relics.* In this report Dyall provides a synthesis of all Aboriginal sites located during his surveys of the Mount Arthur Coal lease area. The survey was conducted as a forerunner to the construction of the Bayswater Power Station. The report divides the area into various landscape elements such as creeklines and provides a total of the artefacts located in each. Of interest to this study are the results of survey along Saltwater Creek. Although, the survey is conducted south of the current study area, Dyall located a number of sites along Saltwater Creek's banks. One site located eight metres above the creek on a terrace is described as 'one of the largest Aboriginal camps' he has seen. A thick scatter of stone flakes and flaking cores cover at least one acre, extending back at least 100 m from the creek. Dyall also found 27 axe-sharpening grooves on the western side of a sandstone shelf. Further scatters of artefacts are located along both sides of the creek bank. Much of this area today is covered by the waters of Plashett dam.

Hughes PJ. 1981. *An Archaeological Survey of the Bayswater No. 2 Colliery Proposed Lease Extension Area, Muswellbrook, The Hunter Valley*. Hughes undertook a survey of the proposed extension area to the Bayswater Colliery. The survey resulted in the locating and recording of nine sites scattered throughout the proposed lease extension area. A number of these were located along Ramrod Creek. All of the sites consisted of open camp sites of scatters of stone artefacts. Six of the sites are located along creek lines.

Hughes PJ. 1982. *A Preliminary Report on Archaeological Survey and Salvage Work in the Saltwater Creek Plashett Dam Site Area, Hunter Valley, New South Wales.* Hughes undertook an archaeological survey, recording and salvage of sites in the Saltwater Creek catchment in the area to be affected by the construction of Plashett Dam and downstream dam wall. A total of 86 exposures were recorded where stone artefacts occurred as surface scatters. Artefacts consisted of indurated mudstone, silcrete, chert, quartzite, quartz, porcellanite and a variety of igneous materials. Most were unmodified flakes and cores, however, a range of retouched artefacts were also present. A programme of salvage work was carried out to collect samples of the stone artefacts.

Hughes PJ, Hiscock P & Koettig M. 1985. *Archaeological Investigation at Plashett Dam, Mount Arthur North, and Mount Arthur South in the Hunter Valley, NSW. Volume 1-3.* The authors undertook an archaeological survey of three separate development areas in the Hunter Valley. The areas included the Plashett Dam site and water storage area on Saltwater Creek; a coal mine development on Mount Arthur North; and a coal mine development on Mount Arthur South.

Within the Plashett Dam area a total of 86 open camp sites consisting of scatters of stone artefacts were recorded. The sites were concentrated along creeklines, especially, Saltwater Creek, with the artefacts recorded on bare, eroded exposures. Six of these sites were excavated.

Within the Mount Arthur South study area a total of 136 archaeological sites were located and recorded. These comprised 135 open camp sites with stone artefact scatters and one site consisting of grinding grooves. The survey focused on areas adjacent to Saddlers Creek.

Survey of the Mount Arthur North area resulted in the locating of 93 open camp sites consisting of stone artefact scatters. A programme of excavation and collection was carried out. The survey focused on areas adjacent to Whites Creek. Koettig and Hughes noted that sites tended to correspond in area to the surface exposures in which they were identified. Very few sites were recorded on hill slopes, ridges or along the upper portions of some creek lines where there were large areas of eroded ground.

Sites in all three development areas occurred within the A soil horizon. Consents to destroy were granted by NPWS for sites at Plashett Dam and Mount Arthur South. A salvage program of excavation and collection work was carried out.

Koettig M. 1992. *Assessment of Cultural Heritage Stage 2: Hunter Valley Aboriginal Sites.* This study follows on from the review of Aboriginal, historic and landscape heritage items (Burton *et al* 1990). Its aim is to set out procedures and guide-lines for the conservation and management of Aboriginal sites in the Hunter Valley. Field inspections were undertaken of both known sites and areas not previously surveyed. Existing sites were assessed for impacts due to development, however, no impacts were noted. Four new sites (artefact scatters) were recorded in the Plashett Dam area, and seven open artefact scatters were recorded in the Bayswater-Liddell area.

White E. 1996. *Archaeological Survey in Plashett Dam Catchment*. White carried out survey of two watercourses within the catchment of Plashett Dam, to assess the impact which soil erosion control works would have on Aboriginal sites for Macquarie Generation. Twenty-eight sites, seven isolated finds and 20 areas of PAD were recorded during the survey. Creek flats and footslopes adjacent to Saltwater Creek had very high densities of visible artefacts. Artefacts of indurated mudstone and silcrete were most common, followed by quartz, quartzite, porcellanite, igneous material and petrified wood. Artefact types included axes, hammerstones/anvils, cobble tools, various retouched and/or used tools, elouera, Bondi points, geometrics and various other backed pieces, cores and core-tools, as well as debitage. The archaeology of Plashett Dam is regarded as typical of the Central Hunter Lowlands.

Umwelt Pty.Ltd. 1997. *Archaeological Assessment – Proposed Modifications to Coal Preparation and Transportation System – Bayswater Coal Mine Project.* In 1997 Umwelt Pty Ltd undertook an archaeological assessment of proposed modifications to the coal preparation and transportation system at Bayswater Colliery. The assessment, which included field survey, reviewed three areas of impact in the southern section of the Bayswater No 3 mining lease; the coal processing plant, haul road, and mine access road; the overland conveyer and; the stockpile area at the RCT. The proposed conveyer route passed through the current study area. A total of 36 sites were recorded during the survey, including 28 open camp sites and eight isolated finds. The majority of sites were located on stream banks, particularly around Saddlers Creek and its tributaries. A number of sites were also found on upper slopes and ridges adjacent to watercourses. Artefacts consisted primarily of flakes and flaked pieces. Retouched flakes and cores were also located as well as a hammerstone. Two of the sites OCR4 and OCR5[3] are located with current study area. OCR4 consists of one mudstone flake and OCR5 eight flakes of basalt, mudstone and silcrete.

5.3.3 Sites Registered with DECCW Aboriginal Heritage Information Management System (AHIMS)

Searches of the DECCW Aboriginal Heritage Information Management Systems (AHIMS) register were conducted on the 29th of June, 2009 and identified 124 Aboriginal archaeology sites within a 10 x 6 km radius of the study area (**Figure F5, Appendix A)**.

The results of an AHIMS search and review of past works has resulted in locating a total of 25 Aboriginal sites previously recorded within the immediate vicinity of the study area. The majority of these sites consist of open camp sites containing scatters of stone artefacts and isolated finds. Below is a summary of these sites.

[3] Neither site appeared in the current AHIMS search results.

Table 3: Previously Recorded Aboriginal Sites within or close to the Study Area

AHIMS Site #	Site Type	Site Location	Site Size	Site Contents	Condition
37-2-0008	Open Site	Hillslope	Not Available	Stone artefacts	Not available
37-2-0034*	Open Site	Creek bank	Not Available	122 stone artefacts	Collected
37-2-0081*	Open Site	Creek confluence	Not Available	Stone artefact(s)	Not available
37-2-0094*	Open Site	Bank top	Not Available	10 Stone artefacts	Good
37-2-0500*	Open Site	Gentle hillslope	15 x 15 m	10 stone artefacts	Eroded
37-2-0818	Open Site	Creek spur	30 x 10 m	25 stone artefacts + PAD	Cleared + Grazed
37-2-0819	Open Site	Creek confluence	100 x 30 m	Stone artefacts + PAD	Cleared + Grazed
37-2-0820	Open Site	Creek flat	100 x 30 m	Stone artefacts (1000+) + PAD	Cleared + Grazed
37-2-0821	Open Site	Creek confluence	100 x 40 m	Stone artefacts (1000+) + PAD	Cleared + Grazed
37-2-0822	Open Site	Creek footslope	40 x 2 m	Stone artefacts (100s)	Cleared + Grazed
37-2-0823	Open Site	Creek flat	50 x 30 m	Stone artefacts (1000s)	Cleared + Grazed
37-2-0824	Open Site	Creek footslope	200 x 100 m	Stone artefacts (1000+) + PAD	Disturbed
37-2-0825	Open Site	Creek footslope	100 x 30 m	500 artefacts	Eroded

AHIMS Site #	Site Type	Site Location	Site Size	Site Contents	Condition
37-2-0827	Open Site	Creek footslope	50 x 40 m	100 artefacts + PAD	Cleared + Grazed
37-2-0826	Open Site	Creek footslope	100 x 50 m	200 artefacts + PAD	Eroded
37-2-0828	Open Site	Creek footslope	Not Available	2 stone artefacts + PAD	Disturbed
37-2-0829	Open Site	Creek flat	350 x 50-150 m	30 stone artefacts + PAD	Cleared + Grazed
37-2-0830	Open Site	Creek flat	350 x 50-150 m	30 stone artefacts + PAD	Cleared + Grazed
37-2-0831	Open Site	Creek flat	100 x 50 m	Stone artefacts (1000s) + PAD	Cleared + Grazed
37-2-0832	Open Site	Creek bank	40 x 5 m	200 stone artefacts	Cleared + Grazed
37-2-1934	Open Site	Creek spur	Not Available	21 stone artefacts	Disturbed
37-2-1956	Open Site	Crest low spur	50 x 50 m	4 stone artefacts	Not available
37-2-1957	Open Site	Hill crest	40 x 10 m	12 stone artefacts	Not available
OCR4	Open Site	Creek flat	Isolated find	1 stone artefact	Degraded
OCR5	Open Site	Creek bank	Not Available	8 stone artefacts	Degraded

** site coordinates fall within study area*

5.3.4 Historic Heritage Database Searches

AECOM undertook a search of historic heritage databases on 20 July 2009.

A review of the Australian Heritage Database identified a total of 46 items listed within the Muswellbrook local government area (LGA) (**Appendix B**). Of those, 29 are located within the urban area of Muswellbrook township and four are located in rural areas surrounding Muswellbrook. The remaining 13 items are located in and around Denman, Singleton and Sandy Hollow, or as much larger regional areas. For example, the Blue Mountains is listed as four separate entries. With the exception of the Blue Mountains, which is listed on the RNE, WHL and NHL, all other items are registered on the RNE. A search of a 10 x 10 km search area centred on the study area identified no items listed on the RNE, CHL, NHL or WHL.

A review of the NSW Heritage Branch (DoP) Heritage Database for the Muswellbrook LGA identified a total of 66 historic heritage items (**Table 4** and **Appendix B**). Of those, there are nine items listed on the State heritage Register (SHR), and 57 items listed in other environmental planning instruments. The majority of listed items are located within the urban areas of towns in the region, e.g. Muswellbrook (33), Denman (11) and Kerrabee (2).

There are eight items listed for the rural area surrounding Muswellbrook. One item – Saltwater Creek Underbridge at Liddell – is located in reasonably close proximity to the study area. However, there are no listed items within the study area itself.

Table 4: Historic heritage items listed in the LGAs traversed by the study area

Area	No. of Historic Heritage Items Listed			
	SHR	s.170	LEP/Gaz	Total
Muswellbrook (township)	6	3 (1 x SRA; 1 x DoH)*	28 (27 x REP; 1 x s.130 Order)	37
Muswellbrook (surrounds)	1	1 (SRA)	9	11
Denman (township)	0	1 (DoH)	10	11
Denman (surrounds)	2	0	3	5
Kerrabee	0	0	2	2
Total	**9**	**5**	**52**	**66**

5.3.5 Study Area Site Prediction

Based on a review of previous works in the area, sites listed on the AHIMS register and environmental factors, predictions can be made about the likelihood of archaeological sites being present in the study area, and what they may constitute. The following predictions have been made about the current study area:

- artefacts are likely to occur in areas up to 50 m away from creeklines and watercourses including flats, footslopes and elevated areas;
- sites along creeklines have potential for subsurface deposit;
- stone artefacts are likely to occur within topsoil A horizon and on the eroding B horizon;
- sites are likely to consist of stone artefact scatters and isolated finds comprising of stone flakes, cores and retouched implements; and
- indurated mudstone and silcrete are the most commonly used raw material in the area.

The previous studies highlighted the significant potential for large artefact scatter sites to occur along the margins of Saltwater creek and its major tributaries, especially in the flatter areas. The absence of sandstone from the study area precludes the potential for grinding grooves to occur. The large relatively flat confluence area of Saltwater Creek and the western tributary creek hold particular potential for extensive stone artefact scatter occurring within soil exposures, and extensive areas of associated archaeological deposit more than 100 m from the edge of the entrenched creeks.

6.0 Results of Field Survey and Research

A total of 47 Aboriginal sites have been identified within the study area (**Appendix C**). Four sites were previously recorded and were identified through AHIMS records. A total of 43 new Aboriginal sites were identified through field survey for this assessment. Aboriginal heritage material can also be perceived as an extensive artefact distribution. This is discussed in the following section.

Aboriginal heritage values identified in the course of this assessment relate to the physical evidence of past Aboriginal occupation. To date no non-tangible Aboriginal heritage values have been identified.

This section is subject to review by Aboriginal stakeholders.

6.1 Fieldwork Constraints and Opportunities

The majority of the study area consists of cleared pasture lands. The lands are covered with a thick layer of pasture grasses ranging between 0.5 m and 1.5 m tall, and various weed species. The majority of sampling areas (transects) offered very poor surface visibility of between 0% to <10% **(Plate P1**). Some areas offered slightly higher visibility, although still less than 10% of the ground surface (**Plate P2**).

Small ground surface exposures (1 m^2 to 10 m^2) occur sporadically throughout the study area, particularly in close proximity to the western tributary creek. Several larger exposures also occur (**Plate P3**), particularly as water erosion at the top of high creek banks or on slopes (**Plate P4**). These exposures are most prevalent along the banks of creeks and occur randomly on some slopes. High salt levels in the soil may be one cause of many exposures.

Typically the exposures along the edges of heavily entrenched reaches of Saltwater Creek and its major tributaries occur where cattle tracks have removed vegetation, broken the ground surface and led to initiation of erosion by overland water flow. These cattle tracks follow close to the edge of the high banks and thus have caused exposures that are typically long and narrow next to the creeks. Much wider exposures occur in the eastern tributaries where entrenchment of creeks is more likely a recent post settlement phenomenon.

The amount of surface stone was not uniform throughout the study area. The soils are naturally gravelly, with pebble to small cobble-sized water rounded gravels evident in the southern parts of the study area, especially along the western tributary creek. The gravels are derived from the weathered coal measures. All exposures included rounded and some angular gravels of a range of rock types. In some areas careful observation was required to ensure identified artefacts were distinguished from natural gravels on the basis of conchoidal fracture features or distinct abrasion (in the case of two grindstones).

6.2 Effective Survey Coverage

Effective survey coverage is a calculation of the percentage of archaeological exposure observed during survey as required by DECCW guidelines. Typically in areas of aggrading soil, such as the Hunter Valley, the calculation results as less than 5%.

To calculate effective survey coverage, the ground surface visibility along the route needs to be quantified. This information was recorded for sites and for the sample areas (transects). Effective survey coverage is calculated on the basis of the total area surveyed, exposure and ground surface visibility. Because of the nature of the survey (pedestrian and vehicle-based) and because a representative sample of landscape units were recorded, an analysis of the 29 sample areas (transects) provides the basis for assessing effective survey coverage for the study area.

Effective survey coverage is a function of the amount of ground surface available for detecting surface artefacts. The amount of ground surface visibility is determined by the amount of ground cover (vegetative cover) over the entire transect, the number and total area of exposures in the transect, and the amount (area) of those exposures with bare soil visible. As can be seen from **Table 5** below, ground surface visibility (and therefore the area of each transect available for detecting artefacts, was extremely low. All transects had a ground surface visibility of less than 10%. Impediments to ground surface visibility in this survey included very thick grass and weed cover. Good recent rainfalls throughout the study area have ensured that ground layer species throughout the study area had grown to provide luxurious pasture with near 100% ground coverage.

Details of ground surface visibility and effective survey coverage for each identified Aboriginal site and each transect are provided in **Appendix D.**

Table 5: Ground surface visibility classes

Exposure Area	No. of Transects	Percentage
< 0.01%	0	0
0.01 – 1.0%	24	83
1.01 – 10.0%	5	17
10.01 – 50.0	0	
50.01 – 100.0%	0	
Total	**29**	**100**

As a result of the low level of ground surface visibility, effective survey coverage was generally low, with just under half the sample areas (16 transects) having an effective coverage of 1.0% or less. In all, 24 transects (83%) had an effective coverage of 10 percent or less (**Table 6**). This result could be extrapolated to the entire study area; in other words the effective coverage in 83% of the study area was less than 10%.

Table 6: Effective cover classes

Effective Cover Class	No. of Transects	Percentage
< 0.01%	0	
0.01 – 1.0%	18	62
1.01 – 10.0%	8	28
10.01 – 50.0	3	10
50.01 – 100.0%	0	0
Total	**29**	**100**

6.3 Previously Recorded Sites

The AHIMS register suggests that seven open camp sites were previously recorded close to Saltwater Creek in the study area, although there are doubts as the accuracy of the AHIMS coordinates for three sites recorded by Dyall as described in **Table 7**. Scrutiny of the AHIMS records confirmed that the three Dyall sites occur south of the study area. The incorrect coordinates are due to the previous translation of imperial to AMG coordinates by algorithm in the late 1980s by the former National Parks and Wildlife Service.

A total of four previously recorded sites fall within the study area.

A survey of a major eastern tributary to Saltwater Creek had been conducted by White in 1996, resulting in recording of a series of large open sites in areas where soil erosion works had been proposed. The area surveyed by White intersects with the route of infrastructure (road and pipelines) heading east from the site of the proposed power station.

Three sites recorded by White were encountered and re-recorded during the present survey along the proposed eastern infrastructure corridor.

Table 7: Previously Recorded Sites with AHIMS Coordinates within the Study Area

AHIMS Site #	Recorder & Year Recorded	Notes
37-2-34	L.Dyall 1976	Imperial coordinates on original site card probably incorrectly interpreted and translated to AMG coordinates in AHIMS - description describes observations at the of junction of Saltwater Creek and “Wisemans Gully” (Wisemans Creek?) which is located 2 km south of the study area; an area of 330 m described; 122 artefacts collected next to Saltwater Creek; artefacts observed on both side of creek.
37-2-81	L.Dyall 1978	Old site card includes abbreviated coordinates 034,123 for the Jerry Plains 1:25,000 map suggest use of the 2nd, 3rd, and 4th digits of AMG coordinates, placing the site over 1.5 km south of the study area by Saltwater Creek.

AHIMS Site #	Recorder & Year Recorded	Notes
37-2-94	L.Dyall 1978	Old site card includes abbreviated coordinates 033,133 for the Jerry Plains 1:25,000 map suggest use of the 2nd, 3rd, and 4th digits of AMG coordinates, placing the site just south of the study area and 300 m north of the junction of Saltwater Creek and the western tributary creek; 14 artefacts next to a 15 m deep entrenched section of Saltwater Creek
37-2-500	M.Koettig & P.Hughes 1985	The site card includes abbreviated coordinates 0355/1362 for the Jerry Plains 1:25,000 map which locates the site within the study area. 10 artefacts were observed over a 10m x 10m eroded area on a hillslope. The eroded area was inspected during the present survey and artefacts were not observed amidst the dense angular gravel.
37-2-815	White 1996	The 1996 report by White reports a site "P19" (p.18 of report) comprised of three artefacts in gully erosion of 20 m x 20 m.. This location was located and further detail recorded by AECOM during the present survey. AECOM field notes refer to site code MGA38. In 2009 the site was comprised of four stone artefacts of indurated mudstone, including flakes and one core. The artefacts were located along the edges and eroding into a steep creek gully approximately 2 m in depth. Visibility along the bank top was limited due to heavy grass cover. This left visibility limited to the deflated gully's sides and edges. The exposed area and site dimensions are roughly 10 x 1 m.
37-2-818	White 1996	The 1996 report by White reports a site "P22" (p.19 of report) which matches the location and description of elongated eroded scour on a south east facing hillslope with 25 artefacts. This location was located and further detail recorded by AECOM during the present survey. AECOM field notes refer to site code MGA39. In 2009 the site was comprised of 30 stone artefacts of silcrete and indurated mudstone. Artefact types included flakes, cores and backed artefacts. These were located on erosion scour on the eastern aspect of a low hill. The erosion scour was approximately 90 x 10 m extending from the upper to lower slope of the small hill. The site dimensions are 70 x 5 m. Visibility was very good in the eroded exposure.

AHIMS Site #	Recorder & Year Recorded	Notes
37-2-820	White 1996	The 1996 report by White reports a site "P24" (p.20 of report) which matches the location and description of a site on an "island" of 100 m x 30 m between two channels with thousands of artefacts. This site was located by AECOM and further detail recorded including a rare grindstone. AECOM field notes refer to site code MGA40. In 2009 the site was comprised of over 100 artefacts scattered over a flat "island" between two heavily entrenched creek channels. Artefact material consisted of primarily indurated mudstone and silcrete. Artefact types included flakes, cores, backed artefacts and a grindstone. Visibility was good, with vegetation consisting of ironbarks and some grasses. The site dimensions are approximately 110 x 40 m. The landform and creeklines may have been modified by damming at some time in the past.

6.4 Sites Recorded during Survey

A total of 42 Aboriginal sites with artefactual evidence were newly recorded in the study area as well as three sites previously recorded by White (described above). These are roughly equally distributed between artefact scatters (n=23) and isolated finds (n=19).

All Aboriginal sites located during the survey were open stone artefact sites, or "open camp sites". Several large open sites were identified in the southern section of the study area, associated with the two main watercourses – Saltwater Creek and western tributary creek. These open sites contain the largest assemblages, which are best able to demonstrate the variety of tool and technological types, as well as raw materials which suggest patterns of procurement local raw materials.

The survey results include many locations where only one or a few stone artefacts were found, generally in a localised soil exposure. Archaeological research in the Upper Hunter Valley over the past 20 years suggests that the majority of these sites, located along the creek margins, are all part of a consistent distribution of artefacts, generally found within 50 m of a creek margin.

For the purposes of assessment and subsequent management, these sites have been grouped on the basis of landscape location into distribution areas (**Figure F6**).

The open camp sites is presented below with the most complex open sites presented first, then grouped open sites within "distributions" along discrete creek sections, and then isolated sites and/or low density artefact scatters. "Distributions" are presented as amalgamations of individual sites, which are delineated on the basis of either landform context or disturbance context.

Examples of typical stone artefacts in the study area are shown in **Plate P5** , **Plate P6,** and **Plate P7**.

6.4.1 Site Distributions

Middle Western Tributary Creek Distribution – 15 ha area (MGA Coordinates: 302856E 6412107N to 302267E 6412800N)

The middle western tributary creek distribution is located in the south western corner of the study area and measured approximately 720 m long by up to 200 m wide. A total of five sites were recorded in this distribution.

The distribution includes a contiguous surface expression of artefactual material and represents the area of greatest artefact concentration within the study area. It is typified by Sites MGA8, which is a series of higher-density artefact clusters interspersed with smaller concentrations, and MGA10, which is another continuous distribution of artefacts eroding from the shallow creek banks in this area, with at least one knapping floor present. These two sites are bisected by Site MGA9 which is located on terrain modified by the construction of a former dam (now breached) and a contour bank extending 150 m from the creek bank. The virtually continuous concentration of artefacts on the contour bank in MGA9 is indicative of the pattern of artefact distribution away from the creek margins.

Artefact densities averaged from 1.6 artefacts per m^2 in MGA8 and MGA9 and 1.3 artefacts per m^2 in MGA10. However the figure for MGA10 is the average across the site, and the density of artefacts diminishes rapidly in the last 100 m of the site, which would increase the artefact density at the eastern end to a similar figure for MGA8 and MGA9. This is suggestive that from that point within MGA10, artefact densities drop and is typified by MGA11 and MGA12 which had one artefact and three artefacts respectively.

Across the Middle western tributary creek distribution a total of at least 440 artefacts were observed on the surface, although in some areas the counts are estimates and may actually be many more. It is likely that many more artefacts are buried in the topsoil. It should also be noted that only the eastern side of the creek was sampled in this area and there are likely to be many more artefacts, both on the surface and buried in the topsoil, on the western side of the creek.

Middle Saltwater Creek Distribution – 16 ha area (MGA Coordinates: 303320E 6413635N to 303390E 6412300N)

The Middle Saltwater Creek distribution is located in the south eastern corner of the study area and is defined by the lands associated with the extensive open “meadow” west of the deeply entrenched creek and three sites on the eastern side (MGA31, MGA32 and MGA33). The northern end of the distribution incorporated the lower reaches of a large tributary that runs off the northern side of the southern hill. The distribution includes a total of 11 Aboriginal sites identified along the western and eastern banks of Saltwater Creek and/or the tributary, which are generally 20 m above the creek bed with a pronounced border between the gully sides and the flats above.

Artefact numbers are generally lower in this area than within the Middle western tributary creek distribution, ranging from sites with a single artefact, as at site MGA2, MGA4 and MGA5, to 33 artefacts at site MGA6. This was the largest concentration and is located at the southern end of the distribution on the western side of the creek. Only 60 m north of MGA6 on the eastern side of the creek is the second largest concentration of artefacts (20) in this distribution. Although slightly lower, artefact densities at this site generally paralleled those in the Middle western tributary creek distribution, with 0.1 artefacts per m^2. However it must be emphasised that artefacts were generally identified only within discreet ground surface exposures, usually formed by either stream-bank erosion and/or cattle movement.

Artefact distribution in the northern end of the distribution drops dramatically, with higher instances of isolated finds, typified by MGA21 and MGA22. Ground surface visibility outside the exposures was severely hampered by thick ground cover. It is likely that many more artefacts occur along this stretch of Saltwater Creek, and it is likely that subsurface deposits occur as a continuous deposit, albeit with discreet higher-density clusters of artefacts.

All sites were identified within three metres of the edge of the creek gully and it is not known to what extent subsurface deposits are present away from the creek, but previous studies suggest at least 30 m, whilst MGA9 in the Middle western tributary creek distribution suggests 100 to 150 m.

Upper Saltwater Creek Distribution – 6 ha area (MGA Coordinates: 303390E 6412300N to 303540E 6414330N)

A series of small scatters and isolated stone artefacts along the western and eastern bank of the upper reaches of Saltwater Creek. The landscape here is characterised by alternating entrenched creek with narrow creek flats, to shallow creek gullies with no flats and gentle slopes directly from the creek margins to the hills east and west.

A total of seven Aboriginal sites were located in this distribution. All except one had less than three artefacts. Site MGA28 was an elongated scatter of nine artefacts located on the main access track on a gentle slope approximately 100 m from the creek edge. The track provides a consistent linear exposure in this area, and no other artefacts were identified. Site MGA46 was the only site located on the eastern side of the creek and consisted of one artefact. The evidence suggests an extremely low density artefact distribution across the creek margins and adjacent lower slopes.

Upper western tributary creek Distribution – 4.5 ha area (MGA Coordinates: 302140E 6412935N to 301960E 6413730N)

A series of small scatters and isolated stone artefacts along both banks of the upper reaches of western tributary creek. The landscape here is characterised by a shallow creek bed either with or without narrow creek flats and gentle slopes directly from the creek margins to the hills east and west. Slopes to the west are covered in she-oak and eucalypt woodland and ground exposures are more extensive than on the cleared slopes to the east.

A total of six Aboriginal sites (MGA13 to MGA18) were located in this distribution. The maximum number of artefacts identified at any one site was four. As for the Upper Saltwater Creek distribution, the evidence suggests an extremely low density artefact distribution across the creek margins and adjacent lower slopes.

Switchyard Tributary Distribution – 11 ha area (MGA Coordinates: 303835E 6413699N to 303689E 6412845N)

Two artefact scatters were located along the western banks of a 1st order tributary of Saltwater Creek in the area designated for the switchyard. The landscape is flatter and the tributary wider at its southern end where it feeds into Saltwater Creek. At its northern extent (headwaters) it rises on a gentle slope between two low hills. Its banks are heavily eroded, particularly at its southern extent.

A total of five Aboriginal sites (MGA34, MGA35, MGA36, MGA37 and MGA45) were located in this distribution – one at its northern extent and four at its southern extent. Fifty two stone artefacts, including a grindstone were located at one site at the southern end (MGA34) where the artefacts were recorded on the tributary's eroding banks. As was found with other distributions in the study area, artefact densities and distributions at the upper extent of the watercourse become lower. This is shown by MGA45, located on an erosion scour adjacent to the headwaters of the tributary, consisting of only three artefacts.

6.4.2 Isolated Sites

Two sites were identified that occur in contexts that suggest they are not part of a larger subsurface distribution.

MGA7 – western tributary creek (MGA Coordinates: 302856E 6412107N)

Site MGA7 is comprised of three stone artefacts including an indurated mudstone flaked piece, a silcrete medial flake and a silcrete flaked piece. The two silcrete flakes are located together while the mudstone artefact is 5 m away. Very few other lithics are associated with this site. No other artefacts were identified in several extensive exposures in this lower end of the western tributary creek.

MG- A29 – "Meadow" (MGA Coordinates: 302672E 6412895N)

Site MGA29 is comprised of three stone artefacts including 2 x mudstone flakes and a mudstone flaked piece. The site is within a large sheetwash scour measuring 30 x 8 m, which has eroded to the B horizon and has shallow topsoils (**Plate P7**). Exposures occurred only sporadically across the "meadow" and were limited to small areas of sheet erosion, occasional cattle tracks and the main access track. Ground surface visibility was extremely limited. However, the shallow depth of topsoil at the site and low number of artefacts suggests only a very low density scatter of artefacts across the very gentle lower slopes of the study area.

MGA30 - (MGA Coordinates: 303796E 6413236N)

Site MGA30 is comprised of a single silcrete flake located on the southern aspect of a low hill. The artefact was recorded in a large erosion scour (163 x 53 m) on the crest and upper slope of the hill. Exposure was sporadic over the hill crest and upper slopes. Ground surface visibility ranged from good to extremely limited. Topsoil on the hill was shallow.

(See **Table 7** for description of MGA38, MGA39 and MGA40 which are previously recorded sites in AHIMS)

MGA41 - (MGA Coordinates: 304649E 6412669N)

MGA41 comprises of a single indurated mudstone flake located on an erosion scour on the northern aspect of a low hill. The exposure area is approximately 25 x 10 m in size. Visibility is good in the eroded area. Vegetation consists of ironbarks and grass cover.

MGA42 - (MGA Coordinates: 304540E 6412563N)

MGA42 comprised of a single silcrete core located on a gentle hillslope adjacent to a 1st order creek. The artefact lies on an exposed area of erosion approximately 20 x 10 m is size. Visibility is good in eroded area.

MGA43 - (MGA Coordinates: 304043E 6412556N)

MGA43 comprises of four mudstone and silcrete artefacts located on an erosion scour on the eastern aspect of a low hill. The erosion scour is approximately 30 x 25 m in size and runs from the upper to lower slope of the hill. The site dimensions are 10 x 2 m. Visibility is good in the exposed area and poor in the surrounding area due to thick grass cover.

MGA44 - (MGA Coordinates: 305753E 6414973N)

MGA44 comprises of three stone artefacts of silcrete, quartz and mudstone on the eastern side wall of a small dam near Freshwater Dam. The artefacts lie on an exposed area approximately 40 x 8 m, which is also the extent of the site. Visibility is poor to good due to knee high grasses that occurs in patches.

6.5 Aboriginal Site Types Not Present in the Study Area

Only open stone artefact sites were identified during this survey. The following section discusses other Aboriginal site types which were not found in the study area and suggests reasons for their absence.

Aboriginal Rockshelter Sites

There were no Aboriginal rock shelters identified within the survey area due to the absence of suitable outcropping sandstone.

Rock Engraving/Axe Grinding Groove Sites

There were no rock engravings or axe grinding groove sites identified in the study area due to the absence of sandstone.

Scarred/Carved Trees

Scarred trees are locally rare within the Upper Hunter Valley due to the extent of land clearing that has occurred since European settlement. The study area is a typical example of this practice with large areas (including entire hill landscapes) having been cleared of trees and replaced with improved pasture.

The remaining woodland structure is largely limited to riparian zones, much of which is regrowth. There are few mature trees in the study area that are old enough to carry Aboriginal scarring. All mature trees that were observed were checked for evidence of cultural scarring, but none were identified.

Stone Arrangements

Stone arrangements are humanly arranged set of stones or rocks which form lines, circles as well and cairns and piles…They are sometimes found on rock platforms where engraved images occur and where they are usually identified as having a ritual or ceremonial purpose (Attenbrow 2002: 208).

Given past land use activities in the study area, such as agricultural and farming practices, stone arrangements may not occur undisturbed within the study area. No stone arrangements were identified during survey

Burial Sites

ginal burial sites have been found in a range of soil types and contexts including duplex soil on non-obtrusive hill slope in the Mt Arthur North coal mine area. There is no reason to anticipate that the study area has more sensitivity for burials than any other part of the Central Lowlands.

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7.0 Discussion

The archaeological investigation which forms part of this Aboriginal heritage assessment has identified a typical pattern of Aboriginal heritage material mostly associated with reliable water sources and occasionally occurring on elevated landforms distant from watercourses.

7.1 Many Sites or A Single Distribution?

The Aboriginal heritage evidence within the study area can be understood from different perspectives.

On the surface it appears there are many Aboriginal sites along the creeks. It is true to say there are many discrete areas where Aboriginal stone artefacts ca be observed – 47 such areas or "sites" (**Figure F7** and **Figure F6**).

However, archaeological excavations over the past two decades have also demonstrated that a single site with a number of artefacts is only a small eroding portion of a much larger buried collection of stone artefacts occurring in large numbers. Excavations is comparable landforms in the Hunter Valley and the Cumberland Plain have demonstrated that many sites along a creek are morel than likely part of a single extensive distribution of stone artefacts within archaeological deposit. The extensive hidden archaeological deposit may compared to an iceberg, with sites being the small tips of the iceberg visible above the surface. This notion of a single archaeological deposit connecting sites and from which sites derive is the alternative perspective to the "site"-based perspective.

Aboriginal heritage material occurs as multiple sites. Aboriginal heritage material occurs as an almost continuous area of archaeological deposit with isolated outlier artefacts away from creeks.

The challenge to the archaeologist undertaking an Aboriginal heritage assessment is not to determine whether Aboriginal sites exist within an area. Past archaeological investigations in the Hunter Valley demonstrate that Aboriginal sites are certain to occur in many parts of the landscape and especially along creeks. The challenge to the archaeologist is to accurately define the extent and characteristics of the sub surface Aboriginal heritage – to define the extent and character of archaeological deposit.

A single extensive archaeological deposit is confidently estimated to occur along Saltwater Creek and its major tributaries (**Figure F7**). This deposit will be divided only by creek channels or dividing ridges and spurs between channels.

This discussion addresses the Aboriginal heritage material from both perspectives: as a collection of 49 sites and a evidence of a single broad archaeological distribution that varies in density across the landscape. The two perspectives present different pictures of Aboriginal heritage. Artefact numbers and densities represented in "sites" are minute fractions of numbers and densities encountered in archaeological deposits. Site distance to water is irrelevant if one considers that a archaeological deposit extends from the creek bank and away for over 100 m.

7.2 Aboriginal Heritage as a Collection of Sites

A total of 47 Aboriginal sites were identified within the study area (**Figure F6**). The Aboriginal sites were all open camp sites located in areas of exposure formed by erosion.

In order to discuss the distribution of sites found along the route, a number of analyses were undertaken to explore the factors affecting site location. Ground visibility, existing land-use impacts, taphonomic factors, stream order and distance to water were analysed in terms of site type and the size of artefact scatters. These analyses were based on the data derived from the site and sample area recordings (**Appendix C**).

7.2.1 Distance to Water and Stream Order

In previous surveys of the Hunter Valley archaeological resource, it has been commonly perceived that Aboriginal camp sites are most likely to be found within 50 m of a reliable water source. This perception is more likely to be the result of previous sampling bias than through any rigorous sampling strategy. In the past decade, surveys in the local area, and especially at Mt Arthur Coal (Kuskie 1999; Kuskie and Clarke 2004; Umwelt 2007, 2008; AECOM 2009a) have begun to challenge that assumption. While it is likely that intensive camping or knapping activity is most likely associated with reliable water, the distance to water is not necessarily the key factor.

For example, recent excavations along South Creek in south western Sydney (AECOM 2009b) suggest that archaeological deposit can occur up to 300 m from a reliable watercourse and can be in any landform, particularly in areas with good ”outlook” (see below).

It is also generally assumed that open sites are most likely to be found associated with higher-order streams where there is a reliable supply of water.

A review of the Aboriginal sites identified in this study including their distance from watercourses (**Table** 8) and the stream order (**Table 9)** shows that:

- the majority of Aboriginal open sites (n=42) were found to be located within 100 m of a watercourse. Of those, 38 were located within 50 m and 29 were located within 10 m[4]. The remainder was found up to 375 m from the nearest water source. This tends to substantiate early models of Aboriginal site patterning. However, it must be remembered that visibility across most of the study area was poor.
- of the 42 sites within 100 m of a water source, two thirds were associated with stream order ranking of 3 or higher; and
- 19 sites were located in the vicinity of an ephemeral water course (i.e. stream orders with a ranking of 2 or lower).

[4] The distance from a water source quoted here refers to the distance from the bank of the watercourse, allowing for in-channel flood events. This means that the actual distance to water may be further than quoted.

Table 8: Number of Aboriginal Site Types identified at Increasing Distances to Water Sources

Distance to Water Source (m)	Stream Order					Total
	1	2	3	4	N/A	
0 – 10 m	7	6	16	2		28
11 – 20	1	2	5			8
21 – 30		1	1			2
31 – 50	2					2
51 – 100	1	1	4			6
>100					1	1
Total	**11**	**10**	**26**	**2**	**1**	**47**

- N/A means indicates that the site was not associated with any identified watercourse, or was of a sufficient distance away, that the watercourse was not a likely to be a factor in its location.

Table 9: Number of Aboriginal Sites showing Stream Order and Type

Stream Order	Isolated Find	Artefact Scatter	Total
1	6	6	12
2	4	6	10
3	8	14	22
4	1	1	2
N/A*		1	1
Total	**19**	**28**	**47**

* N/A means indicates that the site was not associated with any identified watercourse, or was of a sufficient distance away, that the watercourse was not a likely to be a factor in its location.

A review of site types and their association with water sources (**Table 8**) shows that:

- sites with more than one visible artefact are more likely to occur in associate on with higher-order streams, albeit only marginally;
- the majority of sites consisting of a single stone artefact (isolated finds) were associated with ephemeral, low order water courses, again only marginally.

In areas where the soil is bare but not heavily eroded, surface evidence (or lack thereof) can sometimes be an unreliable guide to subsurface archaeological content. The lack of surface lithic material evident in the many surface exposures of the study area does not necessarily mean that there are no sub-surface artefacts.

7.2.2 Assemblage Size and Artefact Density

The number of artefacts and the density of artefacts for each Aboriginal site in the study area is presented in **Table 10** below shows the number of sites with their assemblage class. While these assemblage classes are arbitrary, they provide an indication of the number of visible artefacts that can be expected within the study area. Similarly, **Table 11** shows a range of arbitrary artefact density classes.

Generally, the results show that:

- the majority of sites (n=35) are either isolated finds or very low density artefact scatters containing less than 10 artefacts.
- a roughly equal proportion of sites were artefact scatters (n=23) compared to "isolated finds" (n=20). However, the patterning of sites shows that artefact scatters are more prevalent on downstream areas of higher-order streams and isolated finds become more prevalent upstream. This suggests that artefact densities are higher downstream.
- Few sites (n=4) have more than 50 artefacts.
- Of the sites with more than one stone artefact (n=26), the majority of sites (n=24) have less than 1 artefact/m^2, exhibiting very low artefact densities. Only three sites have more than one artefact/m^2 and these were both sites with only two or three artefacts, but associated in very close proximity to each other. Therefore the density of any deposit associated with these sites is likely to be much lower than these figures indicate.

Table 10: Assemblage size

No. of Artefacts	No. of Sites
<10	36
11-20	4
21-50	3
51-100	2
101-250	2
Total	**47**

Table 11: Artefact density

Artefacts per m²	No. of Sites
<0.010	1
0.010 – 0.099	11
0.100 – 0.999	13
>1.0	3
N/A*	19
Total	**47**

* N/A means sites that had only a single artefact.

7.3 Aboriginal Site Potential in Unsurveyed Areas

As discussed in **Section 3.3** the field survey used a targeted sampling approach to identify Aboriginal sites within the study area, and areas where potential archaeological deposits may occur. This section discusses the extent of Aboriginal heritage material from both a site by site perspective and an archaeological distribution perspective. The observations made on the survey compared against the common understanding of Hunter Valley archaeology provide a basis for predicting a broad expanse of potential archaeological deposit with a reasonable degree of confidence.

7.3.1 Aboriginal Site Patterning

Open sites are the main Aboriginal site type occurring in the study area. They appear to be found in two contexts:

1 in areas of greatest water reliability, particularly in association with higher order water courses (≥ stream order 3); and

2 on lower to mid foot slopes that overlook a water source, but are slightly elevated to avoid periodic flooding.

7.3.2 Aboriginal Site Location Predictions

The patterning of Aboriginal site locations allows the development of a general Aboriginal site location model covering areas of the study area that were not surveyed. While it is accepted that Aboriginal people lived in all areas of the environment and left evidence in all parts of the landscape, this discussion focuses on landscape areas where past repeated Aboriginal activity left the most obvious and enduring archaeological signature, suitable for interpretation and heritage management.

Open sites, comprising stone artefacts on the open ground, or as subsurface deposits, are likely to occur within 100 m of a high order creek or river, although they may be found up to 200 m from a water source. Although the sites identified in this survey provide a discreet surface expression of the area's archaeology, it is considered that they are generally part of a much broader archaeological deposit. Deposit is considered to occur along the banks of Saltwater Creek and the western and eastern tributary creeks to varying degrees (**Figure F7**). The downstream (higher-order) sections of the creek associated with the "meadow" contain deposits up to 100 m from the creek banks, whilst the upstream (lower order) sections contain lower density deposits up to 30 m from the creek banks. Fewer open sites are likely to be found adjacent to ephemeral low order streams.

7.4 Aboriginal Heritage as a Single Distribution

Archaeological deposit varies in its extent and in the density of artefacts across space. Excavations in the Hunter Valley have typically identified clustered distributions comprised of knapping floors interspersed with lower density distributions of stone artefacts. Higher order creeks such as Saltwater Creek are typically associated with broader distributions extending more than 200 m from the creek edge. The flatter areas in the southern part of the study and eastern tributary creek valley area may be more amenable to camping. The presence of more reliable water sources in the larger creeks, especially Saltwater Creek, would have increased the likelihood for repeated Aboriginal camping and activity and hence led to a greater accumulation of archaeological material. This would have resulted in an extensive distribution of stone artefacts along the margins of the creeks, with greater revisitation and greater build-up of archaeological material in lower reaches where conditions were more suitable for camping and hunting.

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8.0 Significance Assessment

8.1 Principles of Assessment

8.2 Defining Cultural Significance

Heritage sites, objects and places hold value for communities in many different ways. The many heritage values are summed up in an assessment of "cultural significance".

The primary guide to management of heritage places is the Australia ICOMOS Burra Charter 1999. Article 1.2 of the Burra Charter defines cultural significance as follows:

> *Cultural significance means aesthetic, historic, scientific, social or spiritual value for past, present or future generations.*
>
> *Cultural significance is embodied in the place itself, its fabric, setting, use, associations, meanings, records, related places and related objects.*
>
> *Places may have a range of values for different individuals or groups.*

8.2.1 Scientific Value

Scientific value refers to the contribution that the heritage resource (i.e. an Aboriginal site or archaeological distribution) can make to knowledge and understanding of the past. It is assessed according to the rarity, representativeness or research potential of a site. These factors are inter-related. The degree to which the heritage resource can contribute to knowledge is summed up in the notion of significance. Significance increases according to the degree of research potential, rarity of a site or area.

Research potential or demonstrated research importance is considered according to the contribution that a heritage site can make to present understanding of human society and the human past. Heritage sites, objects or places of high scientific significance are those that provide an uncommon opportunity to inform us about the specific age of people in an area, provide a rare glimpse of artistic endeavour or provide a rare chronological record of changing life through deep archaeological stratigraphy.

The capacity of a site to address research questions is predicated on a definition of what the key research issues are for a region. In the Upper Hunter region the key research issues revolve around the chronology of Aboriginal occupation and variability in stone artefact manufacturing technology. Sites with certain backed implements from the Holocene are very common, but sites with definite Pleistocene evidence are extremely rare, and hence of extremely high significance if found.

Some archaeologists suggest that the value of a place/object can be judged by answering the following questions:

- can the site contribute knowledge which no other resource can?
- is the knowledge relevant to general questions about human history or other substantive subjects?

Rarity and representativeness are related concepts. The comparative rarity of a site is a consideration in assessing scientific significance; a certain site type may be "one of a kind" in one region, but very common in another. Artefacts of a particular type may be common in one region, but outside the known distribution in another.

The integrity of a site is also a consideration in determining scientific significance. While disturbance of a topsoil deposit with artefacts does not entirely diminish research value, it may limit the types of questions that may be addressed. A heavily cultivated paddock may be unsuited to addressing research questions of small-scale site structure, but it may still be suitable for answering more general questions of implement distribution in a region and raw material logistics.

To adequately assess significance, evidence is required which includes information about the presence of subsurface deposits, integrity of these deposits, nature of site contents and extent of the site. A review of information about previously recorded sites within the local area and region enables the rarity and representativeness of a site to be assessed.

- High significance is usually attributed to sites, which are so rare or unique that the loss of the site would affect our ability to understand aspects of past Aboriginal use/occupation for an area. In some cases a site may be considered highly significant because its type is now rare due to destruction of the archaeological record through development.

- Moderate significance can be attributed to sites which provide information on an established research question.

- Low significance is attributed to sites which cannot contribute new information about past Aboriginal use/occupation of an area. This may be due to site disturbance or the nature of the site's contents.

8.2.2 Social/Cultural Value

Social value refers to the importance of the heritage resource to a particular social group. When referring to the value of heritage sites and places to the Aboriginal community the term cultural value is also used. Long-standing attachment to places due to traditional stories or ceremonial significance attached to a place can give rise to strong social significance. Social values may be derived from attachment or engagement with a place due to the embodiment of traditional character and identity in the evidence of past life. Often social values stem from the archaeological evidence and the attachment that community members feel for the evidence of past Aboriginal lives and activity.

8.3 Aboriginal Heritage Values

Aboriginal heritage values identified to date within the study area are derived from the physical evidence of past Aboriginal activity. No non-tangible Aboriginal heritage values have been identified, although Aboriginal consultation will be ongoing in relation to the proposed development.

Aboriginal heritage values identified within the study area include:

- pre-contact Aboriginal activity evident in the widespread stone artefact evidence present within the topsoil in close association with creeks and some nearby slopes;
- a pre-contact landscape of high intensity Aboriginal activity associated with Saltwater Creek and its major tributaries and associated flat land distinct from low intensity activity in the upper reaches of creeks where creek margins are more inclined; and
- rare evidence of Aboriginal grinding tools in two sites.

The scientific aspects of heritage also have cultural value to the local Aboriginal community through their strong interest in the tangible connection that it represents with pre-European Aboriginal cultural life and land use. No other Aboriginal social values have been identified by the Aboriginal community groups consulted through this project. Requests have been made to the Aboriginal community for confirmation of the Aboriginal community heritage values.

8.4 Assessment of Significance

The significance of Aboriginal heritage material within the study area can be made on two levels: 1) a site by site basis, and 2) archaeological distribution basis. The evidence of Aboriginal heritage material on these two levels is discussed in **Section 7.0.** The significance of Aboriginal heritage material is presented in **Figure F8.**

8.4.1 Significance Site by Site

All Aboriginal sites identified within the study area are open stone artefact scatter sites. Relevant considerations in assessing the level of significance are the assemblage content and whether the landscape pattern differs from that already established.

The well-established pattern of Aboriginal site distribution, as exemplified in the salvage excavations at Mt Arthur North (Southeast Archaeology 2004) is:

- Aboriginal sites occur in all parts of the landscape;
- Aboriginal sites differ in the density of artefacts within exposures – more being found closer to creeks;
- a greater concentration of stone artefacts may be anticipated closer to high order creeks;
- artefact densities revealed in excavations close to creeks are generally 35/m² median and up to 1,000/m ² in dense knapping floor concentrations;
- artefact densities in excavations of landforms distant from creeks are typically less than 1/m²;
- artefact densities in surface exposures are a poor guide to buried content and hence detailed comparison of surface densities can provide an inaccurate picture of the heritage resource;
- Artefacts generally co-occur with exposures close to creek, in contrast to areas more than 50 m from creeks where exposures without artefacts are more abundant, reflecting isolated artefact discard in these locations;
- Aboriginal site content includes mostly flakes and broken flakes of indurated mudstone/tuff and silcrete with minor proportions of quartz, igneous stone, porcellanite, petrified wood and quartzite;
- backed artefacts are regularly found as a small proportion of assemblages (1%-5%) and associated artefacts are mostly the manufacturing by-products of backed artefact production; and
- abraded artefacts such as stone hatchet heads, grindstones and mullers are rare.

The sites found within the study area are assessed as to how they fit this pattern. The contribution of archaeological deposit is considered separately in the following section.

Aboriginal sites considered in isolation within the study area are generally of a low or moderate significance with the following exceptions:

Site 37-2-820 (P24) is of high significance. The site, located on the eastern tributary creek at the edge of the infrastructure corridor, contains an eroding silcrete knapping floor which is an excellent example of its type and contains a rare complete small grinding stone. The site is of high educational value as a site with discrete boundaries, visible artefact evidence and a rare artefacts type within a near-natural woodland setting.

Site MGA35 is of high significance. The site, located by a tributary to Saltwater Creek, contains a rare grindstone fragment. The site is of moderate educational value as a site with a rare artefact type amidst a typical stone artefact scatter.

All other sites are of moderate significance as each of them include artefact assemblages which complement current understanding of artefact assemblage contents, artefact types and site location. With the exception of the two sites of high significance, none of the other sites are located in unusual landscape contexts and none have rare assemblage contents. Each of these sites is of educational value as typical examples of their type. Sites with higher numbers of artefacts such as MGA6, MGA8, MGA10 and MGA12 are of slightly higher educational value given that artefacts may be more readily detectable in future visits.

None of the sites could be considered to be so disturbed as to be of low significance. Artefacts of low density are not automatically given a low significance, given that each site contributes equally to understanding the archaeological landscape.

8.4.2 Significance of the Archaeological Distribution

Aboriginal heritage material is contained within topsoil as archaeological deposit in some parts of the landscape. The characteristics of archaeological deposit established in past Hunter Valley archaeological excavations are as follows:

- archaeological deposit is comprised clusters of stone artefacts positioned within a background scatter of stone artefacts;
- stone artefact clusters, typically knapping floors, may be overlapping or closely spaced close to favoured resource extraction locations such as reliable water sources or stone quarries;
- artefact densities decrease as one moves away from a watercourse;
- archaeological deposit may extend over a greater area next to higher order watercourses;
- archaeological deposit generally occurs within 50 m of 2nd and third order creeks, but the extent of deposit next to major creeks has not been sufficiently explored or defined;
- archaeological features such as hearths are rare;
- datable material reliably derived from cultural activity is rare (e.g. charcoal derived from a hearth as opposed to charcoal commonly occurring in fire due to natural bushfires);
- spatial associations between utilised implements and manufacturing of new implements occur infrequently; and
- archaeological deposit is absent in elevated locations where artefacts occur as isolated instances without associated deposit.

Archaeological nature is by its very nature buried and hidden. This assessment is therefore an assessment of research potential against a defined model of the archaeological landscape. The pattern of site location and site content provides some insight into the deposit.

The area south of site MGA32 near the confluence of Saltwater Creek and the eastern tributary creek is of high significance for its extensive archaeological deposit and the potential for research into archaeological distributions next to heavily entrenched high order creeks in the Hunter Valley. The flat landform and distinctive naturally entrenched creek morphology provides strategic hunting opportunities for large game combined with large flat potential grassland areas for seed gathering.

The large extent of potential or potential archaeological deposit is illustrated in **Figure F7**. Excavations of the comparable deeply entrenched Bayswater Creek on the Narama Mine in 1991 (Brayshaw McDonald 1992) revealed a rich and extensive artefact assemblage whose distributional characteristics were not defined at the time. Recent archaeological excavations by AECOM in comparable landscape settings in the Cumberland Plain have demonstrated that archaeological distributions extend over hundreds of metres back from the edge of creeks (ENSR AECOM 2009).

Soil exposures along the creek edges in the southern part of the study area are, for the most part, associated with stone artefacts ("sites"). This is indicative of a continuous archaeological deposit in this area. In contrast, the area north of the eastern tributary confluence includes more exposures than artefacts, indicative of a low density and patchy deposit. The greater relief along creek edge landforms in the northern area may also be suited to a more limited spread of campsites. Archaeological deposit alongside the upper reaches of Saltwater Creek is certainly demonstrated in current salvage excavations on the Drayton lease immediately north of the study area (N.Baker pers.obs), but early results suggest artefact densities may be low (<10/ m² average) and indicative of a string of activity locations rather than repeated camping sites. For this reason the potential archaeological deposit north of site MGA32 is considered of moderate significance.

8.5 Social/Cultural Values Identified

To date AECOM has not received feedback on the cultural heritage value of the study area to the Aboriginal community. Consultation with Aboriginal community groups in nearby locations have suggested that there is a common interest in the well-being of Aboriginal sites. Aboriginal communities are interested in being consulted over the management of Aboriginal sites and find value in engaging directly with the heritage through field inspections.

The values of the site will be updated on receipt of feedback from the community as consultation continues for the Bayswater B Power Station project.

8.6 Summary of Aboriginal Cultural Heritage Values and Significance

In summary, the heritage values of the study area include:

- pre-contact Aboriginal activity evident in the widespread stone artefact evidence present within the topsoil in close association with creeks and some nearby slopes;
- a pre-contact landscape of high intensity Aboriginal activity associated with Saltwater Creek and its major tributaries and associated flat land distinct from low intensity activity in the upper reaches of creeks where creek margins are more inclined; and
- rare evidence of Aboriginal grinding tools in two sites.

In summary the significance of the Aboriginal heritage sites and potential archaeological deposit identified within the study area include:

- the highly significant Aboriginal sites 37-2-820 (P24) and MGA35 due to the presence of rare grindstones.
- the remaining 45 Aboriginal sites of moderately significance due to their typical content which contributes to an understanding of the archaeological landscape and Aboriginal cultural heritage.
- there are no Aboriginal sites of low significance.
- Aboriginal archaeological deposit of high significance occurs in the southern part of the study area south of MGA32. The potential archaeological deposit in this area has high research potential to answer current unresolved questions the extent and character of archaeological sites close to entrenched major creeks where exposures suggest rich assemblages occur with rare artefact types.
- Aboriginal archaeological deposit of moderate significance occurs north of site MGA32 and is anticipated to be useful to demonstrate known characteristics of Aboriginal sites, but not anticipated to reveal new information or address current research questions.

9.0 Impact Assessment

9.1 Project Construction Details

9.1.1 Coal Fired Power Generation

The coal fired option would include the main power station footprint and development of infrastructure including:

- use of the existing Antiene Rail Loop for the delivery of coal;
- construction of a new conveyor to transport coal from the Antiene Rail Loop to the Bayswater B site;
- construction of an access road from the existing Bayswater access road;
- raw water supply pipeline connecting the Bayswater B site to the freshwater supply dam;
- construction of an ash haulage route;
- ash disposal point within an existing mine void within a 10km radius of the Bayswater B site;
- re-alignment of the existing transmission line to connect the Bayswater B switchyard;
- live coal stock pile (short term coal storage area) within a dry storage enclosure;
- long term coal storage yard.

The power station footprint and associated infrastructure for a coal fired plant is provided in **Figure F9.**

9.1.2 Gas Fired Power Generation

The gas fired option would include the main power station footprint and development of infrastructure including:

- gas supply pipeline;
- construction of an access road from the existing Bayswater access road;
- raw water supply pipeline connecting the Bayswater B site to the freshwater supply dam;
- re-alignment of the existing transmission line to connect the Bayswater B switchyard; and
- gas spur line to connect Bayswater B to the approved Queensland to Hunter natural gas pipeline which will be constructed approximately 20km to the north east of the site.

The power station footprint and associated infrastructure for a coal fired plant is provided in **Figure F9.**

Pipeline Corridor

For the gas power station option, the proposed gas pipeline corridor from the Bayswater B site extends to the north east towards the Antiene Rail Loop, and then continues north-northeast. The proposed pipeline would traverse approximately 18km of land before connecting with the approved Queensland to Hunter Gas Pipeline (QHGP) near Beggary Creek Road. The pipeline corridor is shown in **Figure F9.** Two-thirds of the proposed pipeline route is on MacGen-owned land; the pipeline corridor predominantly crosses grazing land.

The detailed design and future Project Application would also include a confirmation or re-assessment of any changes to the locations and associated infrastructure assessed in this report.

9.1.3 Summary of Impacting Development

In summary, possible impacts to Aboriginal heritage may derive from three aspects of the proposed development:

1. the footprint of the proposed gas or coal powered power station and switching yard located near Saltwater Creek in the southern part of the study area;
2. the various routes of proposed infrastructure comprising roads, pipelines and transmission lines heading north, north east and east from the power station; and
3. the temporary lay down area for materials during constructions located generally to the north of the proposed power station.

The potential impacts are identified here. Measures to mitigate impacts and manage Aboriginal heritage are discussed in the next section.

9.2 Potential Impacts to Aboriginal Heritage

9.2.1 Power Station and Switching Yard Footprint

The proposed gas or coal fired power station footprints are to be located on the flat ground between Saltwater Creek and the western tributary creek. This area includes the potential archaeological deposit which is of significance for its promise in revealing complex archaeological evidence addressing current archaeological questions around Aboriginal landscape use, stone technology and the spatial patterning of archaeological campsite evidence by major creeks.

Although only one recorded site will be impacted by the current proposed positioning of the power station options, the large area of significant potential archaeological deposit will be impacted.

The proposed switching yard will impact the isolated find site MGA30 and will also impinge on the area of significant potential archaeological deposit occurring in the southern part of the study area. Line connections from the switching yard to the current transmission lines will skirt site 37-2-500.

9.2.2 Infrastructure Routes

The proposed ash haulage road and conveyor route heading north from the power station skirt the edges of the less significant northern archaeological deposit and will not constitute an impact on Aboriginal heritage.

The proposed gas pipeline connecting the gas fired power station option from the north east posses over site MGA44 and passes through the area of significant archaeological deposit where it crosses Saltwater Creek.

The proposed road and associated infrastructure heading generally east from the power station toward the existing Bayswater power station will impact a number of small sites and skirts the highly significant site 37-2-820 (P24) and the site 37-2-818 (P22). Current plans suggest the following sites will be impacted: MGA5, MGA43, MGA42, MGA41 and 37-2-815 (P19). The eastern infrastructure route will impact the area of significant potential archaeological deposit where it crosses Saltwater Creek. The route also crosses potential archaeological deposit along the eastern tributary creek.

9.2.3 Lay down area

The temporary lay down area refers to the general area where materials will be temporarily stored during construction. The area is approximately three times the size of the power station footprint and located on adjacent suitable land. Although not precisely defined, the lay down area should be considered as suitable open land without significant direct access constraints to the power station footprint. This area is likely to include the area of significant potential archaeological deposit between Saltwater Creek and the western tributary creek.

9.3 Cumulative Impacts

Within the Hunter Valley regional context, cumulative impact is difficult to assess given the large scale land impacts due to mining. A calculation of creek length comparing areas previously impacted, proposed to be impacted and areas remaining provides a local assessment of cumulative impact.

Impacts will occur on Aboriginal heritage sites and archaeological deposit over a combined area of approximately 50 hectares and along an 800 m stretch of Saltwater Creek. The combined area is calculated by adding the area of the power station connected to the area of the switching yard and all infrastructure between located on or near potential archaeological deposit and recorded Aboriginal sites. The length of affected Saltwater Creek includes the reach crossed by infrastructure.

Present and past Aboriginal heritage investigations have identified Aboriginal sites along most parts of Saltwater Creek, and buried Aboriginal heritage material is predicted along its entire length, with more significant deposit anticipated from the southern part of the study area and continuing to the Hunter River, approximately 9 km downstream.

A length of approximately 5 km was previously impacted by inundation with the construction of Plashett Dam in past decades. An appraisal of air photo imagery in Mapinfo mapping software suggests 3 km of Saltwater Creek remains intact below Plashett Dam. Approximately 1 km of Saltwater Creek remains intact between the study area and Plashett Dam. Approximately 4 km of Saltwater Creek flows within the study area, which is bounded by the distinctive east-west conveyor line bordering the Drayton mine area.

These figures indicate that of the 13 km of Saltwater Creek counted here, 5 km has been previously impacted by Plashett Dam, leaving 8 km intact. Of this 8 km remaining, a length of 800 m or 10 % will be impacted to some degree by the construction of the power station and associated infrastructure crossing the creek. Approximately 7.2 km of Saltwater Creek, with its associated archaeological deposit, will remain intact following the proposed impact.

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10.0 Heritage Management Commitments

10.1 Principles

The management of cultural heritage is determined in accordance with the cultural significance of the heritage site, place or heritage resource. This assessment has identified Aboriginal sites and potential archaeological deposit of high significance which will be impacted by the proposed development.

The options for repositioning aspects of the development to avoid impacts are limited (in the case of the power station footprint) or non-existent (in the case of infrastructure crossing Saltwater Creek). These commitments respond to the significance of the identified Aboriginal heritage and limited capacity to modify development footprint within current landform constraints.

10.2 Commitments

10.2.1 Sites to be Fenced and Avoided

The small island of ground surrounded by creek channels defining the highly significant site 37-2-820 (P24) will be fenced and avoided by the eastern infrastructure corridor.

The soil exposure defining the highly significant site MGA35 will be fenced and avoided by construction of infrastructure crossing Saltwater Creek.

Fencing shall comprise star pickets and high visibility construction fencing (or similar suitable materials) and shall be removed on completion of construction.

10.2.2 Collection and Set-Aside of Impacted Aboriginal Sites

The contents of Aboriginal sites impacted by the development shall be collected and relocated to the closest area within the same landform not impacted by the development. This site relocation exercise will be conducted by the Aboriginal community working with an archaeologist who will recorded the destination locations of artefacts moved and prepare a report to be deposited with relevant DECCW files. The collection and set aside procedure will be undertaken prior to commencement of construction and when the development footprint is finalised. The intention of this measure is to keep Aboriginal artefacts from sites without significant research potential “in-country” rather than in boxes within a keeping place.

10.2.3 Test Excavation of Significant Potential Archaeological Deposit

A program of archaeological test excavation followed by archaeological salvage excavation is warranted to accurately clarify the extent of archaeological deposit suggested in this assessment, and to identify appropriate areas of concentrated archaeological material suitable for archaeological salvage excavation.

Prior to the granting of project approval the extent of potential archaeological deposit should be clarified through archaeological test excavation. The test excavation will entail a systematic sample of test pits dug in at 20 m intervals in multiple transects spanning the area identified in this report as potential archaeological deposit. The use of bulk earth moving methods of archaeological investigation will be avoided during this testing phases (e.g. “grader scrapes”). All soil from test pits will be wet screened through 5 mm and 3 mm sieves for the purpose of identifying all stone tools including fine debitage indicative of knapping floors.

Recovered artefacts will be subject to appropriate forms of analysis and reported in accordance with relevant guidelines.

The test excavations will be conducted by a suitably qualified and experienced archaeological team working with the Aboriginal stakeholders.

10.2.4 Salvage Excavation

Salvage excavation will occur in locations of significant deposit or features as identified through test excavations. The salvage methodology may include a number of excavation methods and will be limited to the development impact area. The salvage will include as a minimum:

- at least two large area excavations by hand, with wet sieving to 3 mm screen, of >100 m² or more if significant artefacts, features or artefacts are found during testing or in the course of salvage;
- grader scrapes to be conducted after completion of all hand excavations for the purpose of identifying features such as hearths within the topsoil;
- large scale excavation by machine and course dry-sieve mechanical screen for the purpose of recovering larger rare artefacts such as hatchet heads and grindstones. This method is subject to site access by the appropriate machinery.

The salvage methodology shall be detailed in a research design document prepared in consultation with DECCW and the Department of Planning. The research design document will set out the number and placement of various pits, scrapes and open areas. The scale and number of excavations shall be justified by reference to current research questions and evidence required to adequately address those research questions.

Recovered artefacts will be subject to appropriate forms of analysis and reported in accordance with relevant guidelines.

The Aboriginal community will be involved in the salvage excavations.

Salvaged Aboriginal heritage material will be stored in a manner that ensures future generations can access and enjoy the material. The material will be stored in an appropriate keeping place within the Hunter Valley or within the Australian Museum until a suitable keeping place is available.

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Figures

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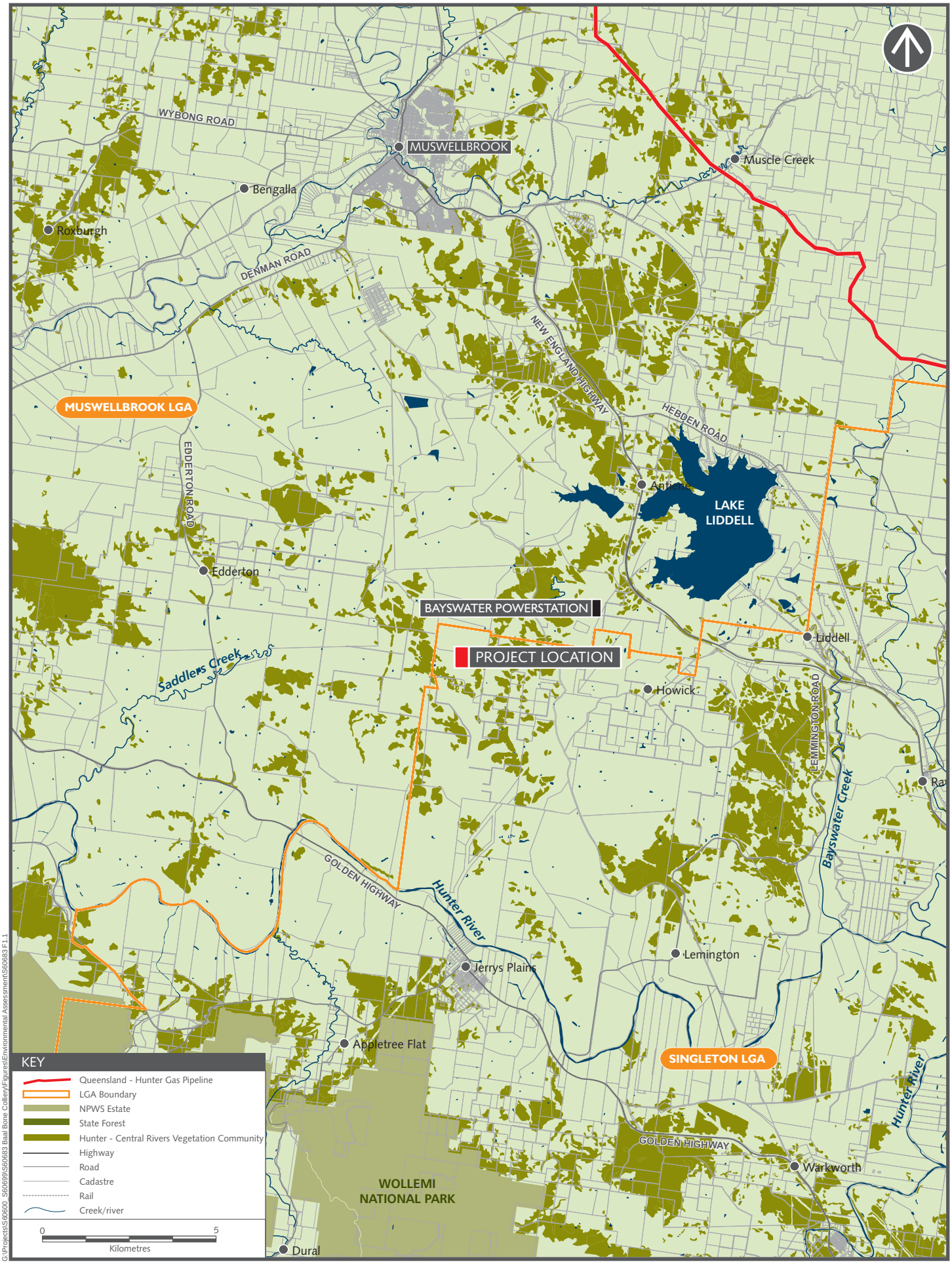

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AECOM

REGIONAL SITE CONTEXT

Environmental Assessment

Bayswater B Powerstation

Figure 1

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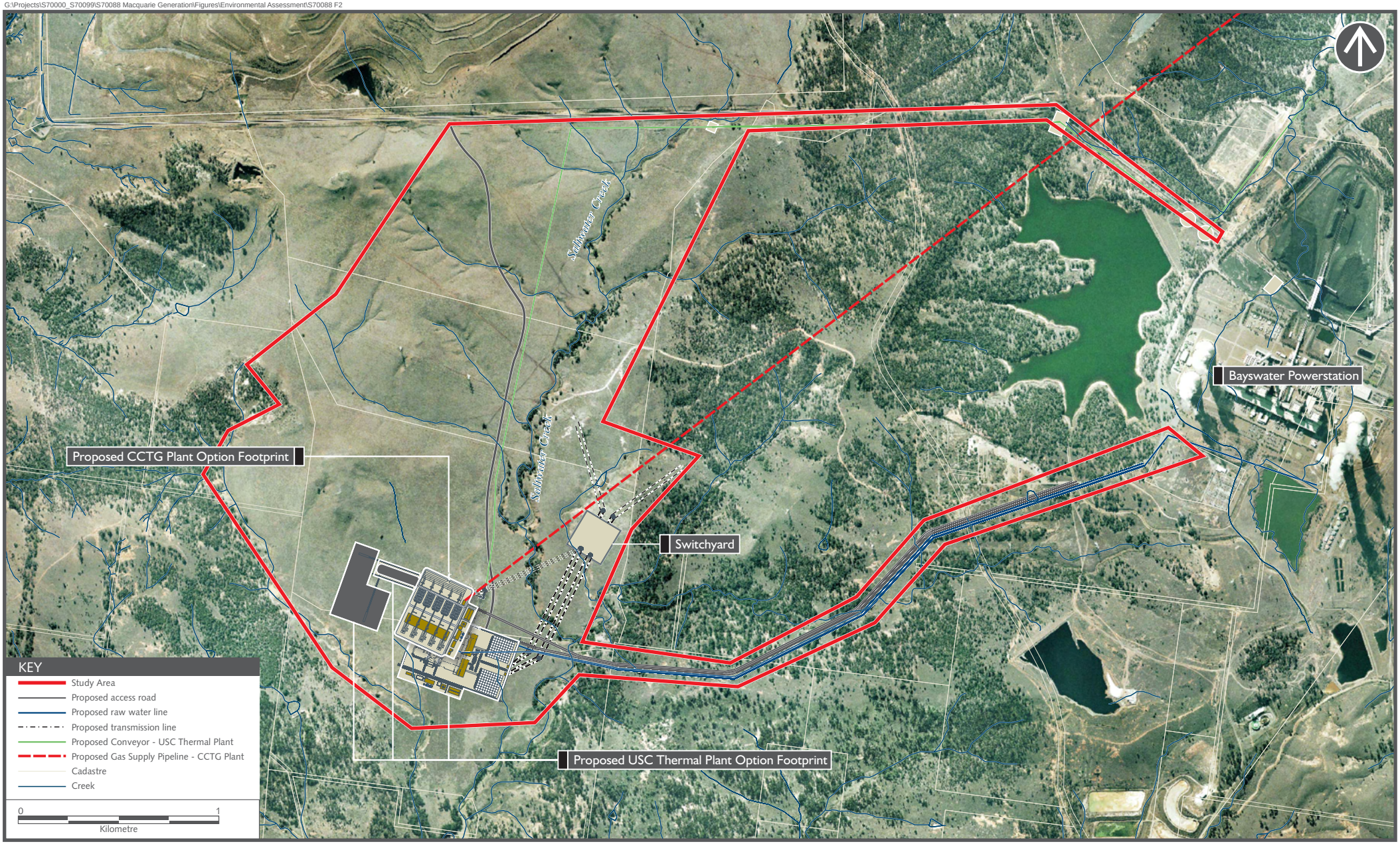

AECOM

PROJECT SITE

Environmental Assessment

Bayswater B Power Station

Figure 2

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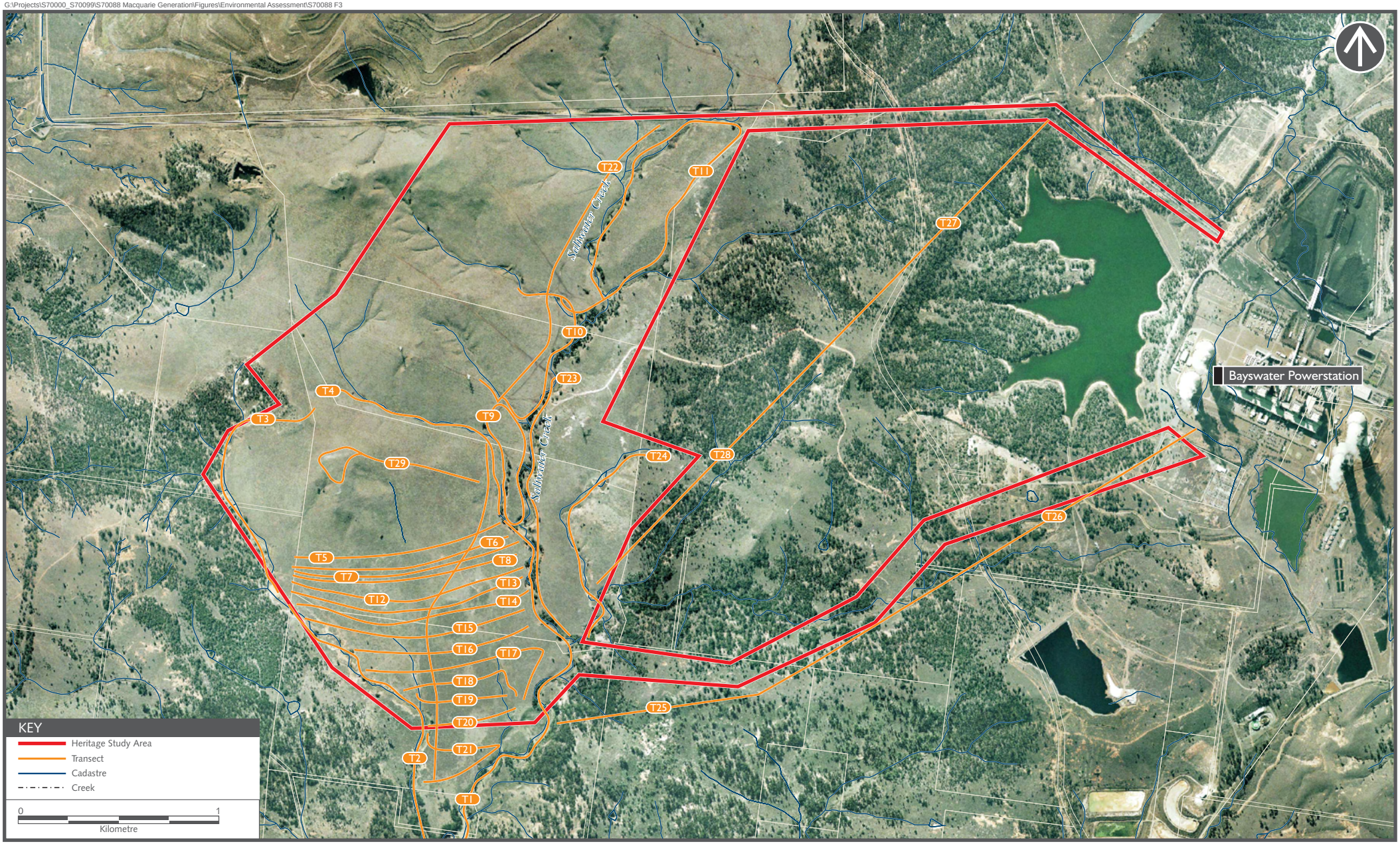

AECOM

TRANSECTS AND SURVEY COVERAGE

Environmental Assessment

Bayswater B Power Station

Figure 3

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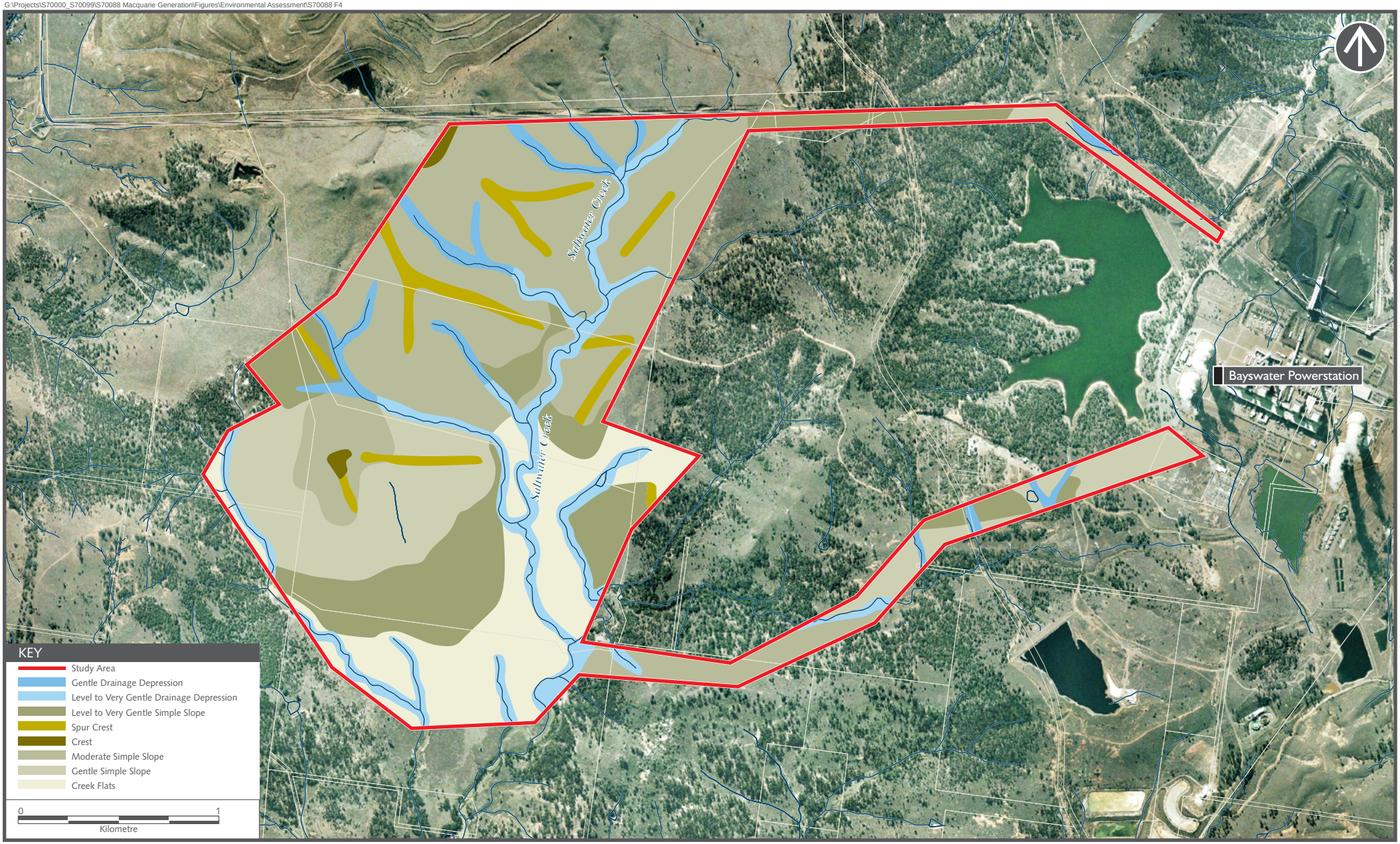

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LANDFORM ELEMENTS

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Bayswater B Power Station

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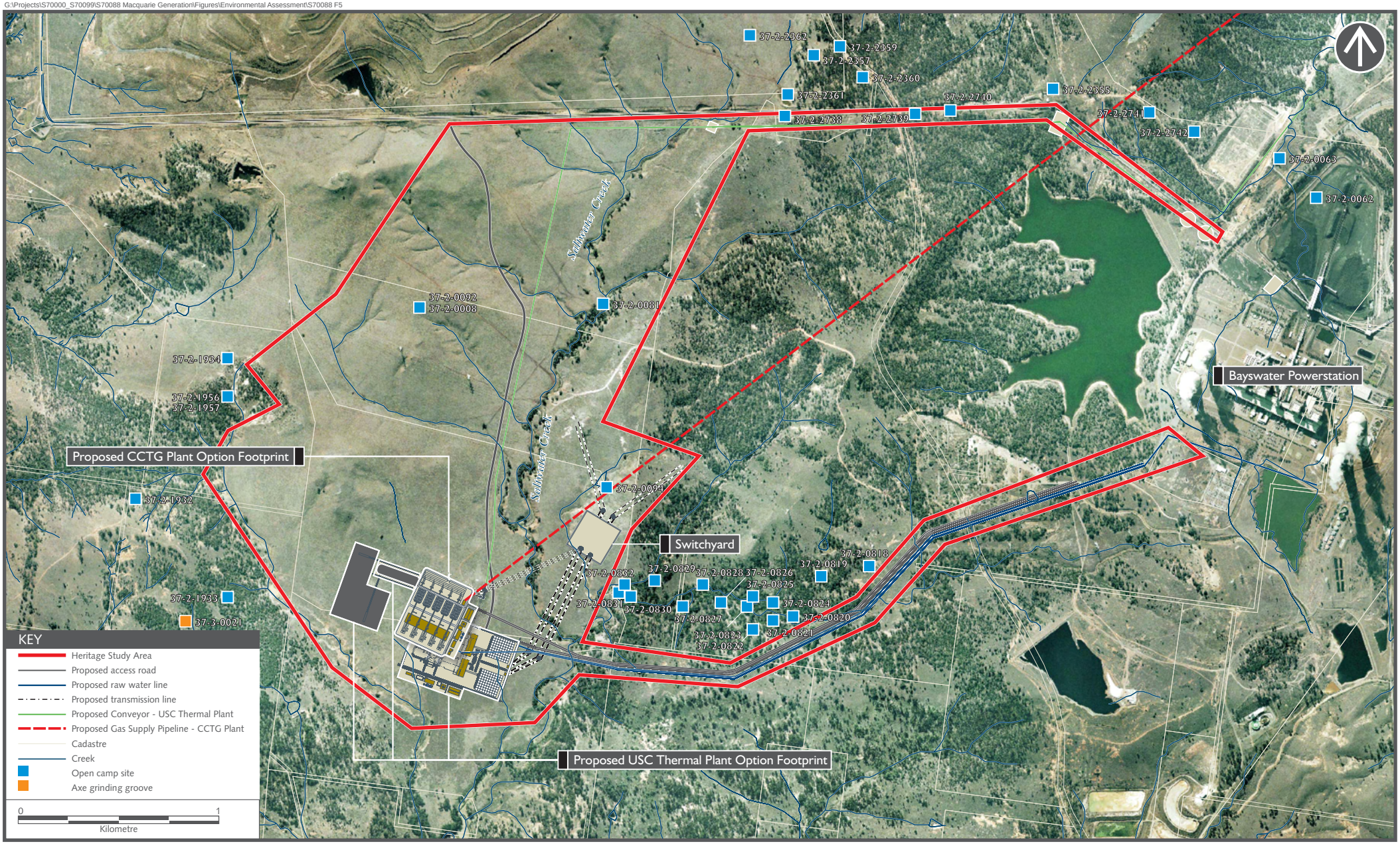

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ABORIGINAL SITES LISTED ON THE AHIMS REGISTER

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Bayswater B Power Station

Figure 5

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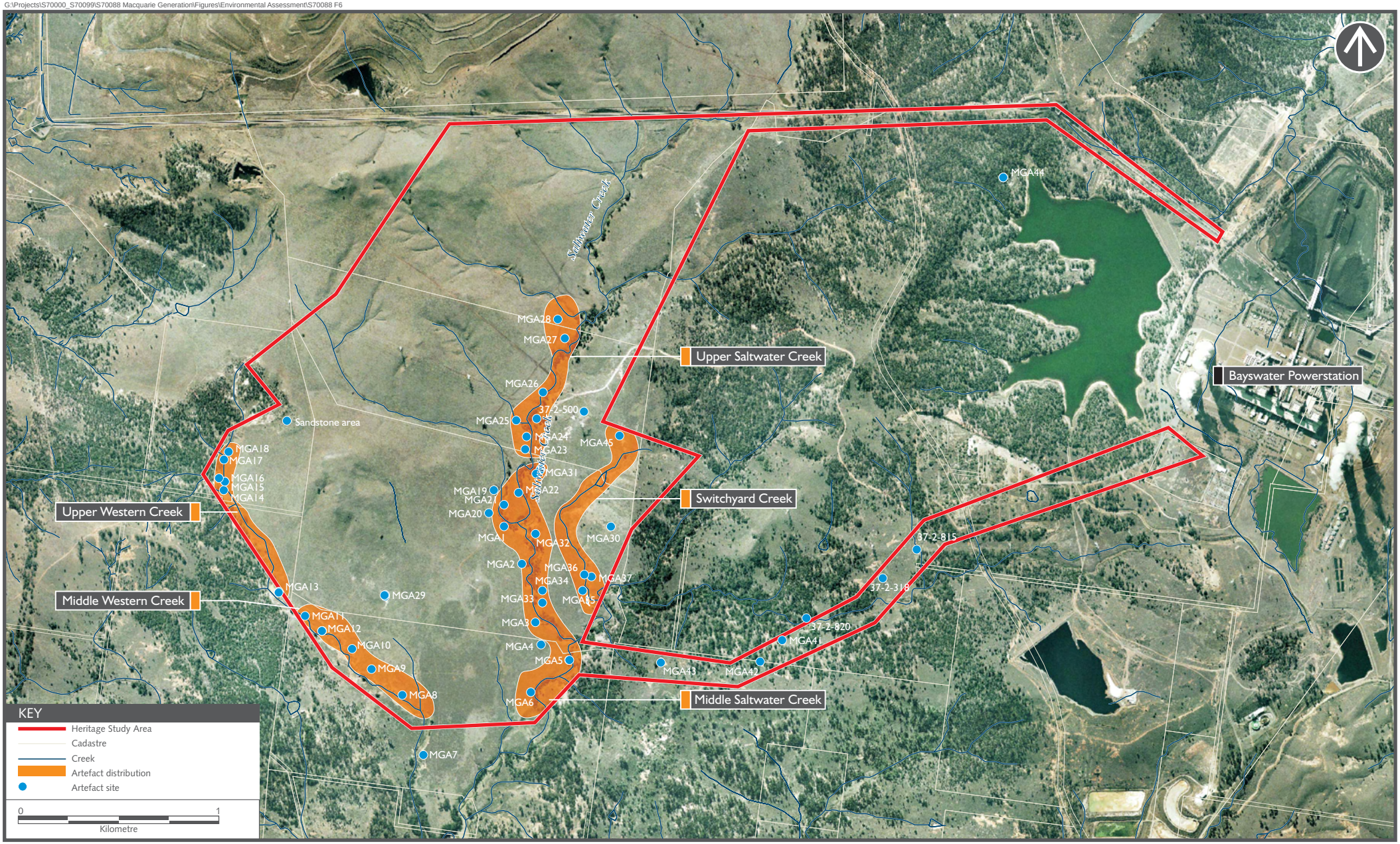

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ABORIGINAL SITES AND SITE DISTRIBUTIONS

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Bayswater B Power Station

Figure 6

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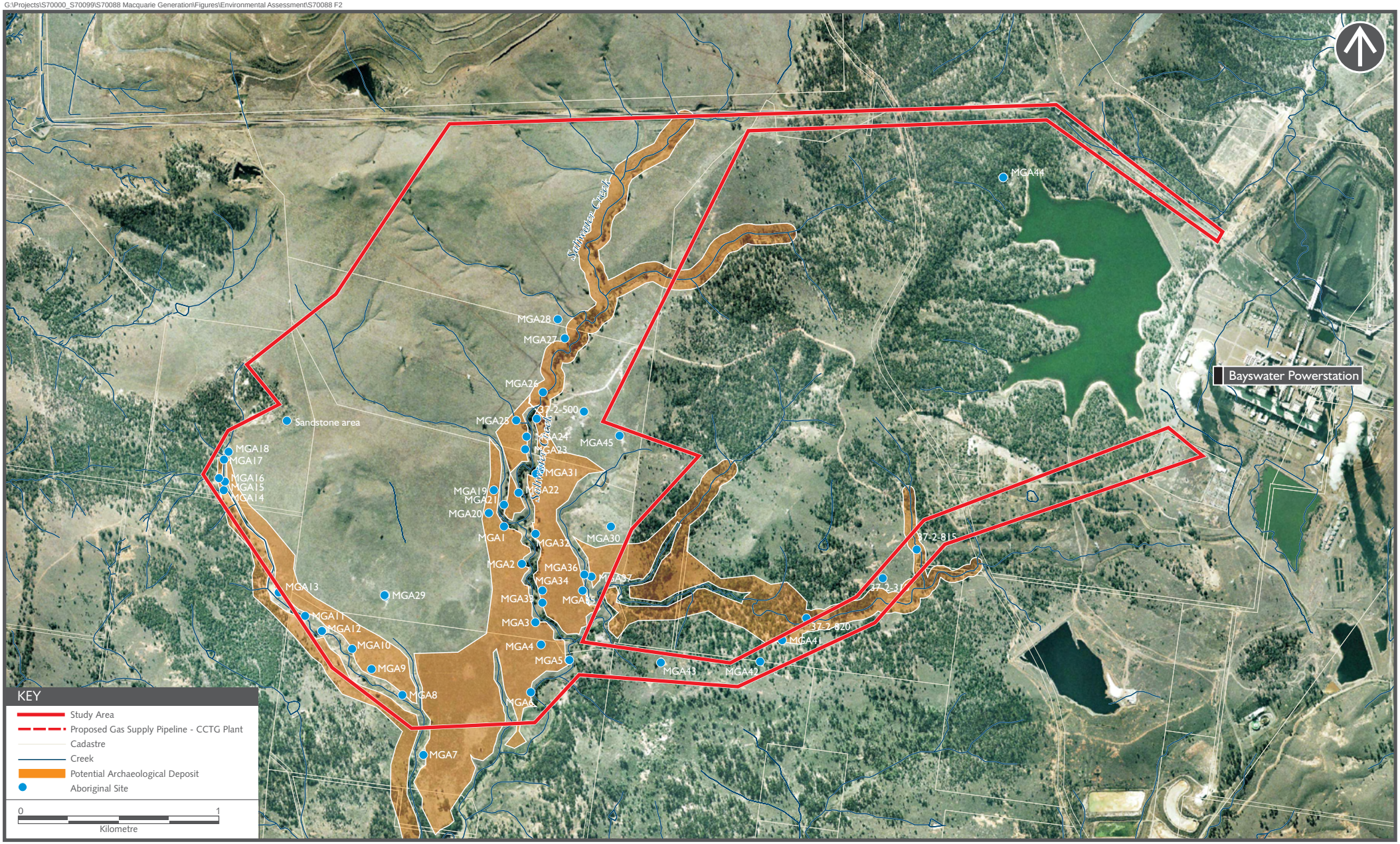

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ABORIGINAL SITES AND POTENTIAL ARCHAEOLOGICAL DEPOSIT

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Bayswater B Power Station

Figure 7

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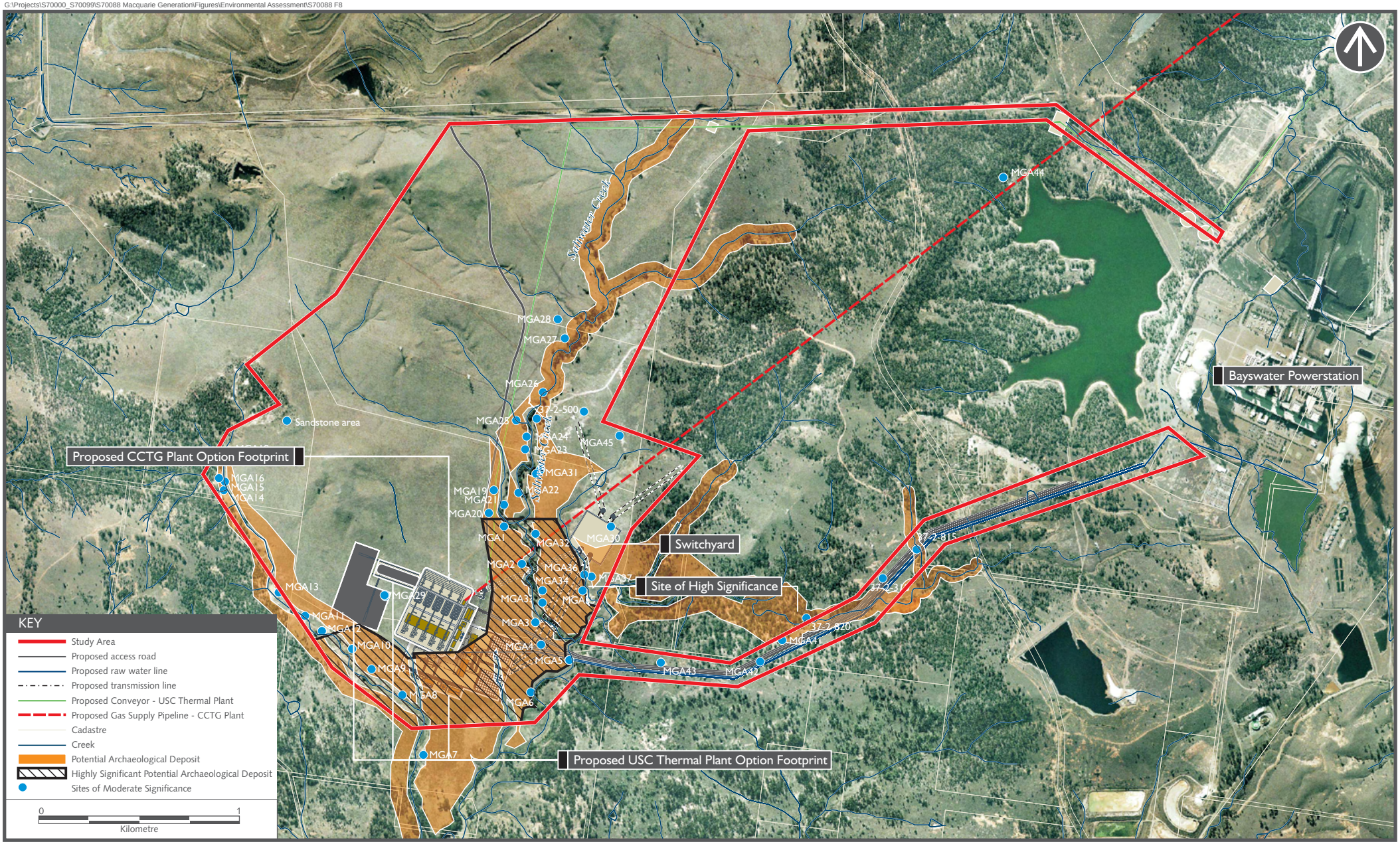

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HERITAGE SIGNIFICANCE

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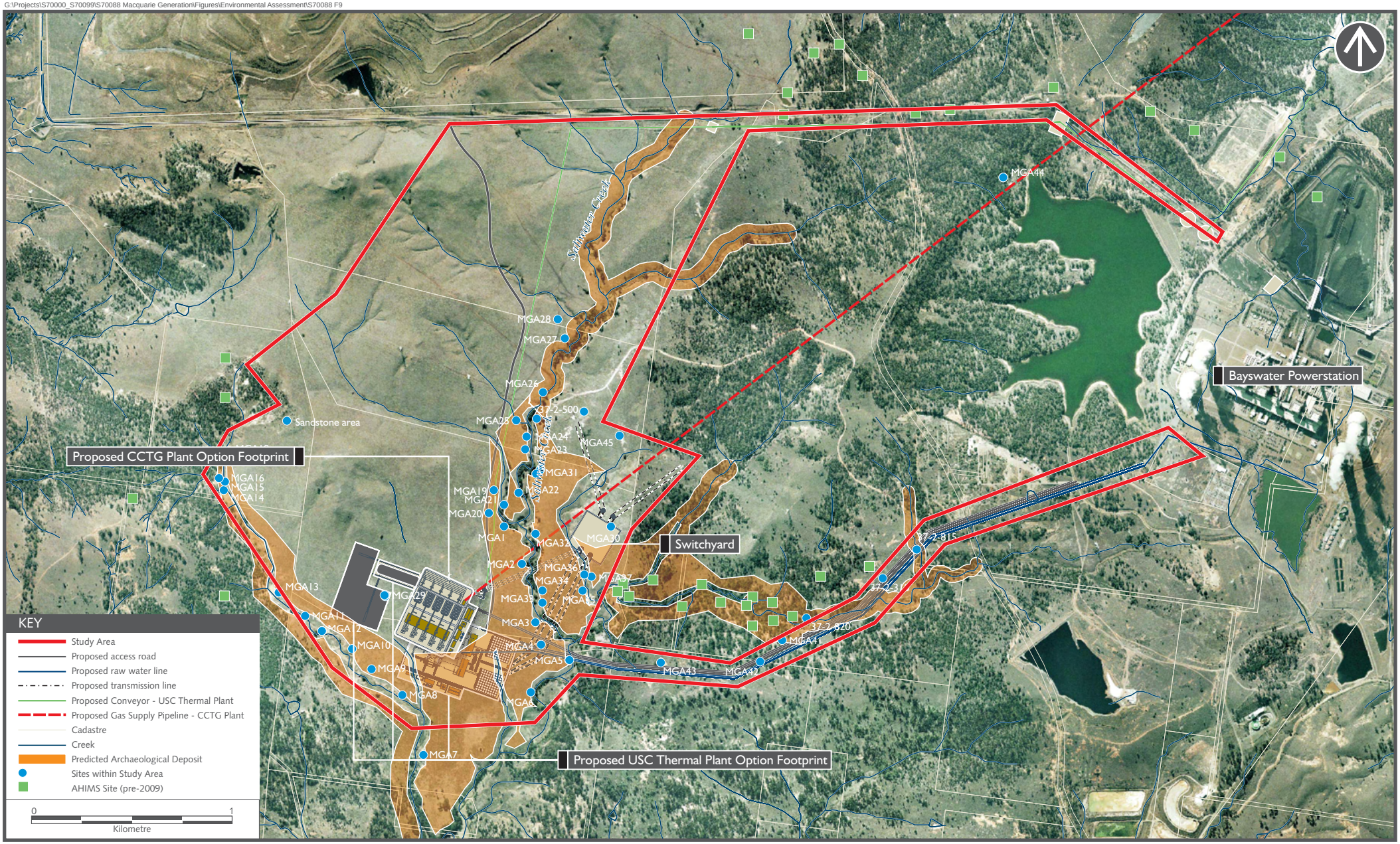

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PROPOSED DEVELOPMENT IMPACTS

Environmental Assessment

Bayswater B Power Station

Figure 9

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Plates

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Plate P1: View south west of vegetation cover in the study area

Plate P2: View south of study area showing vehicle exposure

Plate P3: View north showing area of exposure

Plate P4: View east showing exposure along western tributary creek bank

Plate P5: Examples of artefacts recorded in the study area

Plate P6: Examples of artefacts recorded in the study area

Plate P7: Examples of artefacts recorded in the study area

Plate P8: View north of site MGA29